Mr. Rothberg

WATERSHED WORK PLAN
UTHERLIN CREEK WATERSHED
DOUGLAS COUNTY, OREGON

Prepared under the authority of the Watershed Protection & Flood Prevention Act
(Public law 566, 83rd. Congress, 68 Stat. 666) as amended.

M-3981

WATERSHED WORK PLAN

SUTHERLIN CREEK WATERSHED

Douglas County, Oregon

Prepared under the Authority of the Watershed Protection and Flood Prevention Act. (Public Law 566, 83rd Congress, 68 Stat. 666), as amended.

Prepared by: North Douglas Soil & Water Conservation District

Sutherlin Water Control District

Douglas County

City of Sutherlin

With assistance by:

U. S. Department of Agriculture, Soil Conservation Service

U. S. Department of Agriculture, Forest Service

December 1963

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(Cover - pictures showing all of the major purposes served by this plan)

WATERSHED WORK PLAN AGREEMENT

Between the

NORTH DOUGLAS SOIL AND WATER CONSERVATION DISTRICT

SUTHERLIN WATER CONTROL DISTRICT

DOUGLAS COUNTY

CITY OF SUTHERLIN

(hereinafter referred to as the Sponsoring Local Organizations)

State of Oregon

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organizations for assistance in preparing a plan for works of improvement for the Sutherlin Creek Watershed, State of Oregon, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 stat. 666) as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organizations and the Service a mutually satisfactory plan for works of improvement for the Sutherlin Creek Watershed, State of Oregon, hereinafter, referred to as the watershed work plan, which plan is annexed and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organizations and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about five years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organizations will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to the State law as may be needed in the installation and operation of works of improvement.

2. The Sponsoring Local Organizations will acquire such land, easements or rights-of-way as will be needed in connection with the works of improvement. (Estimated cost $189,000). The percentages of this cost to be borne by the Sponsoring Local Organizations and the Service are as follows:

Works of Improvement	Sponsoring Local Org. (Percent)	Service (Percent)	Estimated Cost (Dollars)
Cooper Creek Multiple Purpose Reservoir and Recreational Facilities			
Payments to landowners for 476 acres & costs for relocation or modification of utilities	50.4	49.6	33,000
Legal Fees, Survey Costs & Other	100	0	3,000
All Other Structural Measures	100	0	153,000

3. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organizations and by the Service are as follows:

Works of Improvement	Sponsoring Local Org. (Percent)	Service (Percent)	Estimated Construction Cost (Dollars)
Plat I Reservoir			
Irrigation Outlet	50	50	130
Remainder (Joint) Costs	9.9	90.1	114,780
Cooper Creek Reservoir			
Municipal Water Outlet	100	0	10,000
Fish Screens	50	50	1,300
Fencing	50	50	6,000
Remainder (Joint) Costs	42.1	57.9	348,970
Recreational Facilities	50	50	101,260
Stream Channel Improvement	0	100	80,460
Diversion Dams	50	50	10,000
Grade Stabilization Structure	0	100	5,050
Clearing and Snagging	0	100	1,600

4. The Service will bear all costs for installation services for all works of improvement for flood prevention, irrigation, and recreation except for installation services on the recreational facilities on Cooper Creek Reservoir covered in Item 5. Installation service costs for these purposes are estimated to be $148,110. (P.L. 566 funds $141,320 and other funds $6,790). Installation services for M&I water ($6,510) will be paid by other funds.

5. Installation services for the recreational facilities will be cost shared by P.L. 566 and other funds. The sponsors will furnish architectural and other specialized services as available from their regular staffs or will pay at least 50 percent of the cost of obtaining these services from other sources. The Service will assist in location surveys and other services normally performed by regular personnel and will pay 50 percent of the cost of obtaining specialized services not available from the regular staff of the sponsors.

6. The Sponsoring Local Organizations will bear all costs of administering contracts. (Estimated cost $7,250.)

7. All costs allocated to municipal water supply will be paid by "other" funds. (Estimated cost $32,970.)

8. The Sponsoring Local Organizations will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

9. The Sponsoring Local Organizations will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

10. The Sponsoring Local Organizations will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

11. The Sponsoring Local Organizations agree that all land on which Federal cost sharing has been provided will not be sold or otherwise disposed of for the evaluated life of the project except to a public agency, which will maintain and operate the recreational development.

12. The Sponsoring Local Organizations will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

13. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

14. This agreement does not constitute a financial document to serve as a basis for the obligation of Federal or other funds. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

    Where there is a Federal contribution to the construction cost of works of improvement, a separate agreement in connection with each construction contract or force account will be entered into between the Service and the Sponsoring Local Organizations prior to the issuance of the invitation to bid, or before approval to begin construction under force account. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

15. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

16. No member or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its benefit.

NORTH DOUGLAS SOIL AND WATER CONSERVATION DISTRICT

By Lamar R. Shannon

Title Chairman

Date 1-16-64

The signing of this agreement was authorized by a resolution of the governing body of the North Douglas Soil and Water Conservation District, adopted at a meeting held on Jan. 16, 1964.

Robert F. Bradley

Secretary, North Douglas Soil & Water Conservation District

Date Jan. 16, 1964

SUTHERLIN WATER CONTROL DISTRICT

By John E. Hahn

Title President

Date Jan 15 1964

The signing of this agreement was authorized by a resolution of the governing body of the Sutherlin Water Control District adopted at a meeting held on January 15, 1964

Secretary, Sutherlin Water Control District

DOUGLAS COUNTY

By V T Jackson

Title County Judge

By E F Metzger

Title Co Comm

By Kay E Brown

Title

The signing of this agreement was authorized by a resolution of the County Court of Douglas County adopted at a meeting held on Jan 21, 1964.

G. D. MYLLENBECK, County Clerk

Clerk, Douglas County Court

CITY OF SUTHERLIN

By Dorothy L. Fox

Title Recorder

Date Jan. 14, 1964

The signing of this agreement was authorized by a resolution of the governing body of the City of Sutherlin adopted at a meeting held on Jan 13, 1964.

Secretary

Soil Conservation Service
United States Department of Agriculture

By

Administrator

Date

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WATERSHED WORK PLAN

SUTHERLIN CREEK WATERSHED

Douglas County, Oregon

December 1963

SUMMARY OF PLAN

The Sutherlin Creek Watershed is located in southwestern Oregon, west of the Cascade Range and about 12 miles north of Roseburg. It has an area of 45.25 square miles (28,960 acres) with 63 percent forest land, 24 percent cropland, and 13 percent urban, roads, industrial, and other land.

The watershed work plan was prepared by the North Douglas Soil and Water Conservation District, City of Sutherlin, County of Douglas, and the Sutherlin Water Control District as the sponsoring organizations, with technical assistance provided by the Soil Conservation Service and the Forest Service of the U.S. Department of Agriculture.

Other agencies and groups who assisted in the preparation of, or furnished technical material for, the watershed work plan include the Bureau of Reclamation, Bureau of Sports Fisheries and Wildlife, Bureau of Land Management, Bureau of Commercial Fisheries, U.S. Army Corps of Engineers, Public Health Service, Extension Service, Farmers Home Administration, Agricultural Stabilization and Conservation Service, Oregon State Game Commission, Oregon State Engineer's Office, Oregon State Water Resources Board, Oregon State Highway Department, Oregon State Soil and Water Conservation Committee, Oregon State Department of Forestry, Fish Commission of Oregon, and Oregon State Marine Board.

The primary objective of this project is the protection of the City of Sutherlin and surrounding lowlands from floodwater damage. A related objective is the reduction and removal of trapped floodwater, enabling diversified use of valley farmland.

Other objectives are to supply irrigation water during the dry summer season and to provide water for municipal, recreational, and fishery purposes.

The works of improvement for protection and development of the watershed will be installed during a five-year period. The total installation cost is estimated to be $1,226,090. The P.L. 566 share is $645,555, while the share borne by other funds is $580,535. In addition, other funds will bear the entire cost of operation and maintenance with an estimated annual cost of $9,545.

Land Treatment Measures

Land treatment measures include practices for watershed protection and flood prevention, and for land conservation and development.

Special consideration will be given to the areas above each of the reservoirs. Land treatment measures in these areas will include erosion control practices on logged over areas, such as critical area planting and skid trail stabilization.

Land treatment measures on the cropland will include land improvement practices for good irrigation water management and for improved land use of the areas protected from flooding.

Cost of these measures is estimated to be $195,670. The P.L. 566 share, $35,620, will consist entirely of accelerated technical assistance. The share borne by other funds is $160,050.

Structural Measures

The structural measures in the plan are: two multiple purpose reservoirs, stream channel improvement, diversion dams, a grade stabilization structure, channel clearing and snagging, and recreational facilities. Total installation cost of these measures is $1,030,420.

Comparison of Benefits and Costs

Primary benefits accruing to structural measures are estimated at $72,210 annually, including flood prevention $28,890, irrigation $9,030, municipal and industrial water $4,290 and recreation $30,000.

The average annual cost of these measures including operation and maintenance is estimated at $42,155.

The ratio of primary benefits to costs is 1.7:1.0. This benefit to cost ratio does not include secondary benefits.

Cost Sharing

All costs for project works of improvement are allocated to the purposes served. Allocated costs will be shared as follows:

Flood prevention: P.L. 566 funds will bear all costs for construction and installation services. Other funds will pay all costs of land, easements, and rights-of-way, relocation of utilities, and administration of contracts.

Irrigation: P.L. 566 funds will pay 50 percent of the construction cost and 100 percent of the installation services. Other funds will bear 50 percent of the construction costs, all land, easements, and rights-of-way cost, and all costs of administration of contracts.

Recreation: P.L. 566 funds will bear 50 percent of all construction costs, 50 percent of the land, easements, and rights-of-way costs, 50 percent of installation services for recreational facilities, and 100 percent of all other installation services. Other funds will bear 50 percent of all construction cost, 50 percent of land, easements, and rights-of-way costs, 50 percent of installation services for recreational facilities, and 100 percent of the cost of legal fees and contract administration.

All costs allocated to municipal and industrial water supply shall be the responsibility of other than P.L. 566 funds. However, under the authority of P.L. 566 as amended, Federal funds will be advanced to pay construction and installation service costs allocated to this purpose since this capacity is designed to meet anticipated future needs. The sponsoring organizations will, within 10 years after the completion of construction, enter into a contract to reimburse the Federal Government for all Federal funds advanced for this purpose.

All costs for operation and maintenance are to be borne by other than P.L. 566 funds.

Project Installation

All responsibilities for installation of flood prevention and irrigation structural measures (including Cooper Creek Dam) will be the obligation of the Sutherlin Water Control District.

The County of Douglas will be responsible for installation of the recreational facilities associated with Cooper Creek Reservoir.

The City of Sutherlin will be responsible for installation of municipal-industrial water supply measures.

The Sutherlin Water Control District and the City of Sutherlin intend to apply for loans under the provisions of P.L. 566 to help meet their project installation obligations.

The installation of land treatment measures will be the responsibility of the individual landowners or operators with such financial assistance as may be available through the Agricultural Conservation Program or other funds. Technical assistance will be provided by the Soil Conservation Service through a cooperative agreement with the North Douglas Soil and Water Conservation District.

Operation and Maintenance

Land treatment measures will be operated and maintained, under an agreement with the North Douglas Soil and Water Conservation District, by the landowners or operators of the property on which the measures are installed.

Operation and maintenance of all structures, except the recreational and municipal-industrial water outlet facilities associated with the Cooper Creek Dam, will be the responsibility of the Sutherlin Water Control District. The City of Sutherlin will operate and maintain the municipal and industrial water facilities. The County of Douglas will maintain the recreational facilities,

including the access road to Cooper Creek Reservoir. The Oregon State Game Commission and the County of Douglas will enter into an agreement with the Sutherlin Water Control District for participation in operation and maintenance of the Cooper Creek Reservoir.

DESCRIPTION OF THE WATERSHED

Physical Data

Location

The Sutherlin Creek Watershed is located in Douglas County, Oregon, approximately 12 miles north of Roseburg. (See project map.) The City of Sutherlin, with a population of approximately 2,500, is located on Sutherlin Creek at the mouth of Cooper Creek, about 8 miles above the confluence of Sutherlin Creek and the North Umpqua River. Wilbur is a small community located on Sutherlin Creek below the City of Sutherlin and about 2½ miles above the mouth of Sutherlin Creek. The watershed has a drainage area of 45.25 square miles (28,960 acres). Sutherlin Creek flows into the North Umpqua River about 4 miles above the junction of the North Umpqua and the South Umpqua Rivers. These rivers form the main Umpqua River which empties into the Pacific Ocean near Reedsport, about 50 miles northwest of this watershed.

Topography

This watershed has a dendritic stream pattern with a southwest aspect. The shape of the watershed is rectangular, about 10 miles long by 4 miles wide. Elevations range from 1,900 feet along the southeast rim to 450 feet at the mouth of Sutherlin Creek. The 10 miles of channel through the flood plain have an average slope of 0.25 percent.

Climate

This watershed has a maritime climate during most of the year with extensive periods of cloudy, rainy weather from November through March. The precipitation tapers off during the spring with almost none occurring during July and August. Precipitation is primarily in the form of rain from general storms associated with extratropical cyclones originating over the Pacific. The location of this watershed between the Coast Range and the Cascade Mountains causes its precipitation to be less than in adjacent coastal regions or in the Willamette Basin to the north. High-intensity thunderstorms are not common here. Sutherlin has an average annual precipitation of 40 inches. Approximately 78 percent of the precipitation falls during the months of October through March, while the months of July and August account for a total of only 2 percent. The peak precipitation month, which can occur any time from October through March, accounts for 24 percent of the annual precipitation.

Temperatures are mild in this watershed. Sutherlin, with a latitude of 43°23' N., has a mean January temperature of 40°, a mean July temperature of 68°, and an average annual temperature of 53°. There is a frost-free season of about 225 days in the farming area.

Water Resources

The surface water resources of this watershed consists of streamflows from Sutherlin Creek and its main branches. Sutherlin Creek Watershed receives some winter precipitation in the form of snow but it has too low an elevation to maintain a snow pack. Most of the winter precipitation runs off immediately as surface flow and relatively little water is retained and released during the dry summer months. The annual runoff on this watershed averages about 20 inches or a little more than 1,000 acre feet per square mile and is directly related to the precipitation pattern. The months of November through March account for 86 percent of the runoff, while the months of July and August together account for a total of 1%.

There are two small privately owned irrigation storage reservoirs which provide water for about 40 acres of cropland. There are several small sawmill ponds near Sutherlin.

Development of subsurface water has been unsatisfactory in this area because of the lack of reliable aquifers. The underlying sandstones and shales of the Umpqua formation have very low permeability rates. The domestic wells of the Camas swale area yield limited amounts of water.

Sutherlin obtains its municipal water supply by diversion and pipeline from Calapooya Creek at Nonpareil.

Geology

The geologic formation underlying the Sutherlin Creek Watershed is the early Eocene Umpqua formation. This formation is composed of interbedded sandstones and shales in the lower portion which grade upward into coarse sandstone and conglomerate with interstratified basalt flows and water-lain tuff.

The beds of the Umpqua formation have been gently folded along northeast-southwest axes. Resistant sandstone, conglomerate or basalt underlie topographic highs, and stream courses and related valleys usually coincide with the less resistant shale outcrops.

Soils

Upland soils within the watershed are closely related to their underlying rock types. The sandstone and conglomerates are generally overlain by light-colored, highly erodible, sandy soils. Soils in the shale outcrop areas are dark-colored, heavy gumbo types. Soils underlain by basalt are usually dark red, medium textured, silty clays. Generally, these upland soils have moderate water holding capacity, moderate to good internal drainage, and rapid surface drainage. These soils are primarily Capability Class VI and VII.

The nearly level flood plain is made up of alluvial materials derived from surrounding rock formations. These soils consist largely of silt loams, silty clay loams, and other heavier clay types. They have moderate to very slow drainage characteristics. These soils are primarily Capability Class III and IV.

Cover Conditions

The cover on the upland watershed area is primarily woodland (mostly cut over) with extensive brush area. This area is about 18,160 acres or 63 percent of the watershed. On the valley fringes and on thin-soiled southerly exposures, the forest cover consists largely of hardwoods (white oak, madrona, and maple) with their associated brush species (hazelnut, cascara, wildrose, oceanspray, and poison oak). At higher elevations and on deeper soils, coniferous forest is predominant, with Douglas fir the principal species.

The cropland generally coincides with the valley floor and is about 6,900 acres or 24 percent of the watershed. Flooding has limited the use of part of this area to unimproved pastures or hay. There are about 35 acres of orchards.

Industrial, commercial, residential and public property areas, such as roads, cover the remaining 3,900 acres or 13 percent of the watershed.

Fish and Wildlife Resources

Sutherlin Creek produces a small number of coho salmon and steelhead and cutthroat trout. Most of these fish utilize the mainstem of Sutherlin Creek with minor numbers inhabiting smaller tributaries, including Cooper Creek. The amount of fishery production is limited by low or intermittent summer streamflows, high water temperatures (particularly in the middle section of the mainstem) and by the lack of spawning and rearing area. Several species of scrap fish inhabit the system in abundance. Salmon and steelhead produced by the Sutherlin Creek system contribute fish to the intensive sport and commercial fisheries in the Umpqua River and at sea. Juvenile steelhead and cutthroat trout support a small local trout fishery in the Sutherlin Creek system.

The watershed area contains small numbers of black-tailed deer, white-tailed deer, ring-necked pheasants, and California quails. A few waterfowl use the area, but hunting pressure is light on all species.

Economic Data

Land Use and Ownership

There are approximately 100 farms in the watershed. Most of the farms are operated by part-time farmers. The average farm size is about 120 acres, ranging from small 15 to 20 acre farms up to 500 acres. The smaller farms are usually all cropland while the larger farms are combinations of cropland and woodland. Most of the cropland is used to produce hay or pasture.

The majority of the woodland is privately owned. There are 1,350 acres of Federally owned land administered by the Bureau of Land Management.

Future land use of the watershed for the major categories, woodland, cropland, and other, will remain approximately the same as present. However, there will be an increase in the amount of irrigated hay and pasture (330 acres)

and most of the perennial hay and pasture will eventually be converted to improved dryland hay and pasture.

Present Land Use

Use		Acres	Percent of Total
Woodland		18,160	63
Cut-over	15,800		
Saw timber	2,360		
Cropland		6,900	24
Irrigated hay & pasture	50		
Orchards	35		
Improved dryland hay & pasture	600		
Perennial hay & pasture	6,215		
Other - roads, towns, residential areas, mills, etc.		3,900	13
Total		28,960	100

Economy of the Watershed and Surrounding Area

Forest and other agricultural products are the basis for most of the income produced in Douglas County. Tourism and outdoor sports are important in localized areas.

Approximately 1.5 billion board feet of timber were harvested in Douglas County in 1960. At an estimated $55 per thousand board feet, the dollar value of this log production, delivered to the mill, is approximately $82,500,000. About one billion board feet come from private land, 280 million board feet from O&C lands (Bureau of Land Management), 243 million board feet from National Forest, and 14 million board feet from State land.

Douglas County produced farm products valued at approximately $6,557,000 in 1959. Crops accounted for $2,075,000 and livestock for $4,482,000. Forest products valued at $900,000 were sold from farm woodlands. Most of the merchantable timber has been logged from the Sutherlin Creek Watershed. The agricultural economy of this watershed will be restricted in comparison to surrounding areas until forest reproduction reaches marketable size and flood protection is provided the cropland areas.

Outdoor recreation is also an important business in this county. The Umpqua River system is nationally known for its salmon and steelhead fishing. Winchester Bay, at the mouth of the Umpqua River, is a popular salt water fishing area, while Diamond Lake, high in the Cascades, is a well known fishing and boating location.

The Sutherlin Creek Watershed is a small part of Douglas County, so it is difficult to estimate closely the share of county agricultural production

contributed by this watershed, however, it does have the same general characteristics as the rest of the county. The farm products are mostly livestock and livestock products. A majority of the residents of the watershed are employed either directly or indirectly by the lumber industry.

Land Values

Land prices in the watershed vary considerably depending upon land use and condition. Uncleared land averages $60 to $75 per acre. The price will vary from this average depending upon the amount of timber. Cleared land will sell from $175 to $250 per acre depending upon the soils and location.

Cleared land in the flood plain area has a value of approximately $250,000. Within the city there is an additional $1,480,000 of commercial, industrial, and residential property located within the flood plain.

Transportation Facilities

A network of all-weather State and County roads provides convenient access to all of the lower parts of the watershed. The upper woodland areas are accessible by private logging and fire control roads. The watershed is also transected by Highways U.S. 99 and Interstate 5.

Railroad freight service is available, with a station at Sutherlin, and several sidings and services at Wilbur and other points.

A moderately improved municipal airport is located in the west edge of the City of Sutherlin. It is now used by private planes and commercial spraying and dusting planes. It can accommodate medium sized commercial airline planes. Scheduled airline and other air services are available at Roseburg, approximately 12 miles south of Sutherlin.

WATERSHED PROBLEMS

Floodwater Damage

The Umpqua River Basin has a long history of severe floods. Since 1861 the main Umpqua River has reached flood stage, during 22 years, near its mouth at Elkton. Sutherlin Creek has a similar record. During the last 14 years it has had 13 damaging floods.

In this watershed, stream runoff is directly related to the precipitation pattern, and the floods occur during the winter months of October through March which also account for 78 percent of the annual precipitation. High streamflows occur 3 to 4 times a year--either from several days of rain of over one inch per day, or from a single day's rainfall of 3 to 4 inches. These high flows ordinarily last for only 2 to 3 days. The stream channels are generally choked with brush and debris and are of inadequate size to carry these flows so that flooding generally occurs at least once annually. Approximately 2,500 acres of this watershed are in the flood plain. In the City of Sutherlin there are about 1½ million dollars of commercial and industrial

Sutherlin business district during 1961 flood

Flooding similar to this frequently occurs on agricultural areas along Sutherlin Creek and its tributaries.

property located on the flood plain. The population on the flood plain is about 2,000 people. Several reaches of the creek have been improved for flood protection by the City of Sutherlin, Douglas County, and individual landowners, but the effectiveness of these improvements is limited by the lack of a coordinated plan. Many of the soils in this valley are heavy with moderate to very slow drainage characteristics. Surface water removal is generally poor, allowing water to remain on the land for long periods of time. The continual flooding of the agricultural lands has reduced its production to a limited pasturing or spring hay and grain cropping. Many needed soil management and cropping practices cannot be applied in this area as long as existing flood conditions continue.

There is a poor correlation between the peak flows, or the depths of flow, from the winter storms and the amount of flooding, or the damages, for specific events. The floods do fall into two general categories:

In the first group, which is the most common, there is little or no flooding in Sutherlin but there is scattered or erratic flooding in the agricultural areas with most of the damage confined to the roads, bridges, fences and cropland. These floods usually cover from 100 to 200 acres of land at scattered locations. Transportation is interrupted with school busses unable to make their runs, mail deliveries canceled, and people unable to get to their places of employment. Fences are damaged and private roads and bridges washed out and cleanup of debris is required.

The second grouping of flood events are those of less frequent occurrence in which there is extensive flooding in nearly all of the agricultural areas and ponding and flooding in the areas of urban and suburban development, particularly in Sutherlin. In these events the floodwater causes damages to homes, business buildings, and industrial areas. These events flood from 1,000 to 2,000 acres of agricultural land and from 100 to 200 acres of residential and commercial urban area. The Sutherlin business district, which serves a shopping area population of approximately 20,000 people, is completely flooded and paralyzed. There has been floodwater in the Sutherlin business district 8 times during the last 14 years. Under present conditions, a typical large flood of this type causes the following types and amounts of direct damages:

Agricultural	$ 9,400	29%
Residential	4,800	15%
Commercial	14,500	45%
Public Roads & Bridges	3,400	11%
Total	$ 32,100	100%

Erosion and Sediment Damage

Erosion in the lower watershed is mainly confined to minor amounts of bankcutting. A large part of the streambank is well protected by vegetation although the channel capacities are frequently inadequate.

Channel degradation and streambank erosion have occurred along the upper tributaries. In this area, sections of channel are choked with logging debris. When the high flows occur in this section, debris forms jams which cause blockage, diversion of streamflow, and increased bank erosion.

Off-stream erosion has generally been confined to abandoned, untreated skidtrails and spur roads. Erosion damage on watershed slopes is low.

Damage results from sediment deposition during each flood, with substantial cleanup required when floodwaters inundate urban and suburban areas. Some localized cropland damage from deposition occurs, but is of a limited nature.

Problems Relating to Water Management

Sutherlin Creek and its tributaries are typical of the low elevation streams of southwestern Oregon. Winter runoff volumes are large but flows decrease rapidly during the spring. Summer flows are only adequate for limited water use development.

Irrigation

Irrigation is limited within the area due chiefly to the lack of dependable water supply during the major part of the growing season. Existing water rights appropriate all available streamflow during the summer months and any expansion of irrigation is dependent on the development of storage, or on sources of water imported from outside of this watershed.

Most of the cropland has heavy clay soil with a slow intake rate. Application rates on the soils must be carefully selected, and the volume of each water application limited to the water holding capacity of the soil in the root zone. These precautions must be taken to avoid excessive ponding and drainage problems on land with restrictive subsoils.

Recreation

There is a shortage of lake or reservoir-based recreational opportunities in this area. There are picnic facilities along some of the nearby streams, but boating, swimming, and reservoir-type fishing areas are limited.

The nearest reservoir is at Cottage Grove, approximately 35 miles distant. Other popular areas frequented by water sports enthusiasts are Diamond Lake, 85 miles from Sutherlin, and Winchester Bay, 55 miles away.

The 1960 census shows the population for Douglas County as 68,458 and the population of Roseburg 11,467. Present population of Sutherlin is estimated to be 2,500. Approximately 60% of the county's people and boats are located with a 25 mile radius of the City of Sutherlin. Local groups are very much interested in developing a water oriented recreational development to serve this area.

Municipal and Industrial Water

The City of Sutherlin obtains its water supply from the natural streamflow of the Calapooya Creek. The supply is adequate to meet present needs, but there is no surplus water during the summer months. There are areas in the city suitable for industrial development, but the water supply will have to be firmed up to make this area attractive to industries. To maintain a progressive development of the community it will be necessary to obtain an additional water supply within the next 10 years.

PROJECTS OF OTHER AGENCIES

There are no other project works of improvement for water resource development installed, or planned for installation, in this watershed at this time or in the forseeable future. The Bureau of Reclamation has completed a special evaluation report on the Umpqua River Basin, dated September 1961. In this report, the Sutherlin Creek Watershed area was mentioned as part of the possible irrigation area that could be served by storage of the Calapooya, and an interstream diversion into this watershed above Sutherlin. There were no specific project recommendations and this study has not been pursued to any degree locally. The Sutherlin Creek Watershed plan will not jeopardize the development of an irrigation program in this area. It will enhance the feasibility of such a program by providing flood protection on a considerable portion of the potential irrigable land, and by acting as a pilot irrigation project to develop interest in irrigation in this area. The Plat I Reservoir can be used to compliment an enlarged irrigation distribution system by acting as a regulating reservoir for a project which might include storage on upper Sutherlin Creek tributaries or a diversion from the Calapooya.

The Portland District Corps of Engineers has published an interim report on the Umpqua River and tributaries, dated February 15, 1951, in which they recommend the construction of local protective works for flood prevention on Sutherlin Creek. The Corps is currently making studies for a survey report of the entire Umpqua River Basin. The measures proposed in this plan have been coordinated with this study to insure compatibility with the comprehensive basin plan. The Corps has cooperated in the development of the Sutherlin Creek Watershed Plan and has agreed that this plan should be developed under P.L. 566. Also, they have indicated that they will include the planned project in the current reappraisal report.

BASIS FOR PROJECT FORMULATION

Project Objectives

The objectives of this project are to provide flood prevention for Sutherlin Creek Watershed and to assist in the full development of the economy of the area. This will be accomplished by the development of a plan for multiple use of watershed soil and water resources.

Full consideration was given to all other water resource plans, existing, or being developed for this area. Consideration was given to the possible

addition of future developments to assure that elements of this plan would not preclude full development of this watershed and adjacent areas.

Land Treatment Measures

Land treatment measures included in this plan are to provide necessary conservation, development, and improvement of individual land ownerships. The measures included are those needed to stabilize land, and to take full advantage of the irrigation water supply and the changes in land use made possible by the flood prevention measures. The land to be irrigated by the project will be irrigated for the first time and will require a different type of treatment and management program than is now in effect. Land treatment measures will help the farm operators obtain the land use, crop production levels, and irrigation efficiency upon which project benefit estimates are based.

The management plan for the lands administered by the Bureau of Land Management was reviewed and determined to be adequate for the protection and management of these lands.

The programs of the Oregon State Board of Forestry, the Extension Service, and the Soil and Water Conservation District, provide adequate guidelines for helping private forest landowners solve their timber and land management problems.

Adequacy of fire protection for the watershed was appraised and as stated by the State Forester, "The present fire protection level is adequate for this area." The forest areas within the Sutherlin Creek Watershed are provided protection from fire by the State Forester through contract with the Douglas Forest Protective Association. Their 1963 fire plan reveals facilities and manpower to adequately service this area. They have four strategic lookouts to detect fires, crews with pumpers subject to immediate call, and additional equipment that is immediately available during the fire season. All of the stations, lookouts, and motorized equipment (including bulldozers) have radio communications.

Structural Measures

The structural measures are planned to meet the sponsors objectives for flood prevention, water-based recreation, irrigation, and municipal-industrial water supply. Alternative measures, levels of protection, and combinations of measures, were studied to determine the most economically feasible measures to accomplish the objectives of the sponsors.

Flood protection levels were determined by evaluating increments of protection to determine the maximum justified level of protection. Flood prevention up to protection for the 1 percent chance storm was appraised. It was found that maximum justifiable level of protection is to confine the peak flows of the 50 year 2 percent chance storm within the banks through the City of Sutherlin and to evacuate within one day the floodwaters of a 10 percent chance storm from the agricultural areas. Protection in excess of this was found to be economically infeasible. These levels of protection are agreed to by the sponsors as being adequate to provide both reduction of damage and encouragement of improvements sufficient to meet their objectives.

Various alternative structural measure combinations to achieve this flood protection were evaluated. A major channel improvement program was considered and also a combination of 5 reservoirs. While the desired level of protection could be obtained with either combination, the objectives of multiple-purpose development and use of the water were not obtainable by the channel program. Reservoir capacity required to prevent floods wholly by this method would be excessive and would require reserving most of the capacity for flood prevention and would interfere with future development plans of the sponsoring organizations. It was determined that a combination of the 2 reservoirs with minor channel improvement provided the necessary protection and permitted the maximum utilization of storage capacity to meet the foreseeable immediate needs of the sponsors and permits the addition of future storage capacity at other sites compatible with this plan.

Each reservoir site was considered for all possible purposes within the objectives of the sponsoring organizations. Cooper Creek Reservoir is planned to incorporate municipal water supply and recreation in addition to flood prevention. The Plat I Reservoir includes irrigation water storage capacity in addition to the primary purpose of flood prevention. In the formulation of plans for both multiple-purpose reservoirs, full consideration was given to the impact on fish and game resources. Structural modifications were included in the design to conform with the recommendations of the fish and wildlife agencies.

Information developed from studies of similar reservoirs and lakes was used to provide the basis for determining structural sizes and other requirements for the recreational development. Surface area, depths, capacities, allowable drawdown, and other similar criteria were used in sizing Cooper Creek Reservoir and for determining the needs for associated recreational facilities. Capacity needed for storage of municipal and industrial water was based on projections of future needs made by the City Planning Commission with consideration given to the impact the other aspects of this project will have on municipal-industrial water requirements. (Note the letter in the appendix section, from the City of Sutherlin, requesting municipal and industrial water supply.)

The principal function of the Plat I Reservoir is flood prevention. It is possible to store water for irrigation after the flood season. This reservoir is planned at this location because it controls a major portion of the area contributing to the floods in Sutherlin (controlling 9 of 16.4 square miles) and due to its location immediately above the primary flood damage area. Plat I Reservoir significantly reduces channel capacity requirements while still providing a reliable point of control.

The Sutherlin Water Control District obtained a sign-up of intent to purchase irrigation water in the area adjacent to this reservoir. This sign-up indicated an interest in irrigation of approximately 330 acres. It was also found that, after the flood season, the reliable yield for storage at this site (790 acre feet) is essentially identical with the net irrigation storage required for 330 acres. To provide a larger capacity for storage would require that the reservoir be enlarged to provide capacity for mid-winter storage. This was determined impractical due to rapidly increasing costs for the additional land purchase and utility relocations. The sign-up

of irrigation interest does not support the inclusion of additional storage sites at this time. The irrigation of additional acreage is a long-term objective of the sponsors that can be accomplished by the addition of storage reservoirs or water from other sources at a later date when that need has developed.

There are approximately 18 miles of natural channel in the flood plain area of this watershed. With the multiple-purpose reservoirs controlling 54 percent of the watershed above the confluence of Cooper and Sutherlin Creeks, channel improvement is required on approximately 4 miles to provide the planned levels of flood protection.

A comparison was made between the costs of clearing and snagging debris from tributary streams above Cooper Creek Reservoir and costs of operation and maintenance that would be required to protect the reservoir from damage and to remove flood-borne debris from the reservoir each year. It was determined most economical to clear and snag 700 feet of these channels where large volumes of material create the most serious hazard.

A natural desilting basin exists on the west fork of Cooper Creek just above the confluence of the east and west forks above the Cooper Creek Reservoir. Degrading of the channel is threatening to destroy the effectiveness of this basin which would release a large volume of sediment downstream. Costs of storing this sediment in the reservoir were compared with costs of stabilizing this area and it was found more economical to build a grade stabilizing structure.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Measures listed under "Soil Conservation Service" in Table 1 are those measures needed to provide the watershed protection, land improvement, and level of agricultural water management necessary to obtain the benefits made possible by installation of the proposed project. Examples of these measures to be installed on cropland include conservation cropping system, irrigation system sprinkler, drainage main or lateral tile drain, and pasture and hayland planting. Estimated installation cost for these measures is $155,250.

Measures for watershed protection to be installed on privately owned woodland include road drainage control, grass seeding, skidtrail stabilization, and gully stabilization. The primary purpose for inclusion of these measures is to assure stabilization of areas where erosion hazards exist above Cooper Creek Reservoir. Estimated installation cost for these measures is $2,400.

Structural Measures

The structural measures included in this plan are the Plat I multiple-purpose reservoir, the Cooper Creek multiple-purpose reservoir, recreational facilities, stream channel improvement, diversion structures, a grade stabilization structure, and clearing and snagging.

Plat I Multiple Purpose Reservoir

This structure is located on Sutherlin Creek about 2½ miles above Sutherlin. The principal purpose of this reservoir is to provide flood protection to Sutherlin and to the agricultural lands above and below Sutherlin.

The dam will be constructed of earth with a top length of about 1,275 feet, height of 30.5 feet, and estimated fill volume, including rock riprap, of 92,300 cubic yards.

The emergency spillway will be excavated in earth in the right abutment. It will not be used except by flows larger than one percent chance event (100 year frequency).

The principal spillway will be provided with a gated outlet at the level of the expected 50-year sediment accumulation. The purposes of this gate are (1) to permit joint use of the reservoir capacity up to the crest of the principal spillway for irrigation water storage as well as flood detention, and (2) to provide for upstream passage of anadramous fish during the winter season. Irrigation storage capacity will be used from about April 1 to November 1 each year. The principal spillway was proportioned so that the velocities during passage of the design storm will be compatible with upstream fish passage. When the principal spillway gate is closed, downstream migrants will be trapped at an existing diversion dam at the upper end of the reservoir and hauled to a point below the dam.

The structure will control 9.00 square miles of the 16.40 square miles of Sutherlin Creek drainage that contributes to the flooding at Sutherlin. The total capacity of flood storage available at the emergency spillway crest elevation is 2,050 acre feet. The use of 790 acre feet after about April 1 for irrigation storage leaves 1,260 still available for flood prevention. The relocation of the Pacific Northwest Bell Telephone Company north-south coaxial cable is an important part of the construction of Plat I Reservoir. A dike will be constructed across the reservoir and the coaxial cable will be buried in the dike above the reservoir water level. The dike will be about 4,000 feet long and it will contain approximately 23,000 cubic yards of fill. A new piece of cable will be laid in the dike and the present cable across the reservoir will be abandoned. Construction of the dam and reservoir will make necessary the relocation of one-half mile of county road.

The estimated total installation cost of Plat I Reservoir is $295,070. See the following tables and figures for additional details: project map; cost distribution, Table 2; structure data, Table 3; preliminary plans, Figures 3 and 4.

Cooper Creek Multiple Purpose Reservoir

This structure is located on Cooper Creek about 2½ miles above its confluence with Sutherlin Creek. Its principal purposes are flood protection, recreation, and municipal-industrial water supply. This structure will control 4.40 square miles of the 6.85 square mile drainage area of Cooper Creek. This

reservoir, together with Plat I, will control 13.40 of 24.70 square miles of the drainage area that contributes to the flooding of Sutherlin.

The dam will be constructed with zones of impervious earth, sandstone, and shale, with a top length of about 400 feet, height of 93 feet, and total embankment volume including rock riprap of 233,000 cubic yards.

The emergency spillway will be excavated in sandstone and shales in the right abutment. It will not be used except by flows larger than the one percent chance event (100 year frequency). The approach section of the emergency spillway is also planned as a parking and boat launching area to be used during the summer recreation season.

The principal spillway is ungated. The flood detention capacity of the reservoir above the principal spillway crest is 785 acre feet, the capacity required for routing of a one percent chance storm.

At the principal spillway crest elevation, the reservoir has a capacity of 3,600 acre feet, a surface area of 131 acres, a length of 1-3/4 miles, an average width of approximately 650 feet, and a maximum depth of 88 feet. During the summer months, 200 acre feet will be withdrawn for municipal-industrial water. This withdrawal represents only 1.5 feet of drawdown on the storage pool and will leave a water surface area of 127 acres which is reserved for recreation.

The intake for the municipal-industrial outlet works is located at about mid-height of the fill to avoid warm surface water and turbid water. Provisions to deliver municipal-industrial water only to the downstream face of the dam are included in this plan.

One hundred ten acre feet of capacity is allotted for storage of the 100 year sediment accumulation.

The reservoir area, up to maximum water surface elevation, will be cleared of trees and debris.

The estimated total installation cost of this structure is $497,490. See the following tables and figures for additional details on: location, project map; cost distribution, Table 2; structure data, Table 3; preliminary plans, Figures 5,6, and 7.

Recreational Facilities

All project recreational facilities will be developed in connection with the Cooper Creek Reservoir. Items to be installed include an access road, boat launching facilities, parking lots, picnic tables, fireplaces, drinking water supply, toilets, swimming areas, and fencing. (See Table 2A for full tabulation of items and Figure 5 for plan of the area.)

The access road will run from the county road to the dam and then to the upper end of the reservoir. There will be two recreational areas, each including a boat launching ramp, parking facilities, and picnic and swimming facilities. One is located near the dam and emergency spillway, and the second near the upper end of the reservoir.

The upper development will cover a larger area and is considered to be the site of principal use. The swimming, picknicking, and parking areas will be larger than the facilities near the dam.

Total land area needed for construction and protection of the reservoir, dam site, and emergency spillway is 472 acres. No additional land will be needed for development of the recreational facilities, but approximately 45 acres within this area will be used for the recreational development.

Total installation cost of the recreational facilities is estimated to be $115,930.

Stream Channel Improvement

The channel improvement will consist of the following works: (1) enlargement of Sutherlin Creek near Wilbur from Interstate Highway 5 bridge, 3,300 feet upstream, (2) channel enlargement and construction of dikes along Sutherlin Creek through Sutherlin from the Southern Pacific Railroad crossing upstream 4,400 feet to the Waite Street bridge, (3) enlargement and alignment of 1,600 feet of Sutherlin Creek in the vicinity of the east city limits, (4) enlargement of Cooper Creek from the mouth 3,900 feet upstream, (5) construction of a surface water interceptor 1,200 feet long, along Waite Street from Central Avenue to Sutherlin Creek, and (6) construction of a floodwater channel 7,000 feet long through Camas Swale. The volume of earthwork involved is 65,000 cubic yards.

The estimated total installation cost of stream channel improvements is $100,690. See the following tables and figures for additional details: location, project map; cost distribution, Table 2; hydraulic and structure data, Table 3A.

Diversion Structures

Irrigation water will be supplied to 330 acres along Sutherlin Creek from Plat I Reservoir to the east city limits of Sutherlin. Storage from Plat I Reservoir will be released into Sutherlin Creek and pumped to the lands from pools created by concrete diversion structures with removable flashboards. The flashboards will be installed during the irrigation season and removed prior to the winter season to allow unobstructed flow in the stream channels.

These structures will be dimensioned to fit the bottom width of the natural stream channel, which averages about 14 feet, and will be located at approximately 1/4 mile intervals on Sutherlin Creek beginning at Plat I Reservoir.

The estimated total installation cost of these ten structures is $12,800. See Table 2 and project map for cost distribution and location.

Grade Stabilization Structure

A reinforced concrete grade stabilization structure containing approximately 42 cubic yards of concrete will be installed to prevent channel degrading and accelerated sedimentation of the Cooper Creek Reservoir.

The estimated total installation cost of the grade stabilization structure is $6,220. See Table 2 and project map for cost distribution and location.

Clearing and Snagging

The tributaries of Cooper Creek above the reservoir contain log jams and accumulated debris. To prevent movement of this material into the reservoir during storms 700 feet of channel will be cleared at an estimated installation cost of $2,200.

See Table 2 and project map for cost distribution and location.

EXPLANATION OF INSTALLATION COSTS

Costs

The total installation cost of Cooper Creek dam and reservoir is estimated to be $497,490. This cost estimate includes $336,270 for construction, $36,000 for easements and rights-of-way, $91,560 for installation services, and $3,660 for contract administration. The construction cost estimates include costs of clearing the area of the dam and reservoir, stripping the foundation and borrow areas of unsuitable material, constructing the foundation and cut-off, constructing the embankment, placing the rock riprap, installing the outlet works and fish screens, installing the municipal water outlet, and the cost of cleaning up and seeding the borrow areas, emergency spillway and embankment slopes. Costs for constructing the recreational facilities associated with the reservoir are not included in the cost of the dam and reservoir. The estimated total construction cost was increased by 24 percent to allow for costs not identified and costs unforeseen in preparation of the estimate. The estimates for easements and rights-of-way include $33,000 for purchase of land and easements, and $3,000 for legal, administration, and survey costs associated with acquiring land rights.. The installation services include $10,000 for core drilling to verify site and foundation conditions, $67,890 for engineering investigations, design and supervision of installation, and $23,670 for other services including overhead costs and direct costs for services provided by other than engineers or geologists.

The estimated installation cost for the Plat I dam and reservoir is $295,070. Included in this cost estimate is $114,910 for construction of the flood control and irrigation facilities, $149,850 for land, easements, and relocation of utilities, $28,750 for installation services, and $1,560 for contract administration. The construction cost estimate includes the costs of clearing the area of the dam and reservoir, stripping unsuitable material from the dam site and borrow areas, constructing the foundation and embankment, installing the outlet works and fish trap, placing the rock riprap on the face of the dam, cleaning up the area and seeding the embankment and borrow areas, and an allowance of 21 percent for contingencies. The easements and rights-of-way costs include $18,850 for construction of the dike and culverts for the coaxial cable relocation, $35,000 for the placement of the cable, $30,000 for road relocation, and $66,300 for purchase of land, easements, buildings. etc. Included in the installation services estimate are $20,700 for engineering

investigations, design and supervision, and $8,050 for other services associated with the installation of the dam and reservoir. The contract administration costs represent the cost of preparing and advertising bids and the associated legal and administrative costs.

The estimated installation cost of the recreational facilities is $115,930. The cost estimate includes $101,260 for construction, $1,100 for contract administration costs, and $13,570 for engineering and other installation services. Included in the estimated cost of construction are the costs of constructing access roads, parking areas, boat ramps, wells, tables, etc., and the cost of landscaping. The construction of the recreational facilities will be entirely within the boundaries of the area necessary to be purchased for construction and protection of the Cooper Creek Reservoir so no land purchase costs specifically for these facilities were included in the estimate.

The estimated installation cost of the stream channel improvements is $100,690. This estimate includes $80,460 for construction, $16,730 for installation services, $750 for contract administration, and $2,750 for easements and rights-of-way. The estimated construction cost includes the cost of excavating the channel, removing and disposing of brush and trees. The construction cost estimate was increased by 17 percent to cover unforeseen cost items revealed by detailed investigation during installation. The estimate for easements and rights-of-way includes the cost of the rights-of-way for channel construction, permanent easement along the channel for maintenance, and the cost of replacing a farm lane bridge in Camas Swale.

The estimated installation cost for the diversion dams, grade stabilization structures, and clearing and snagging is $21,240 which includes $16,650 for construction, $400 for easements and rights-of-way, $4,010 for engineering design, supervision and other installation services, and $180 for contract administration costs. The construction cost includes the cost of constructing ten concrete diversion dams, one concrete stabilizing drop structure, and removal and disposal of brush, trees, and debris from 700 feet of channel.

Cost Allocation

Two structures, the Plat I Reservoir and Cooper Creek Reservoir, will have multiple use functions. The cost allocation was made by the use of facilities method, except for the land, easements, and rights-of-way costs for Cooper Creek Reservoir. The land easements and rights-of-way cost and cost for relocation of utilities for Cooper Creek Reservoir are allocated to recreation except for that percentage of these costs determined by the percent of surface area added to the reservoir by the municipal-industrial water storage capacity. The following table summarizes the cost allocation for Plat I and Cooper Creek Reservoirs:

	Total	Flood Prevention	Irrigation	Recreation	M&I
Plat I	$ 295,070	$ 238,130	$ 56,940	-	-
Cooper Creek	$ 497,490	$ 89,740	-	$ 374,760	$ 32,990

Details of capacities and costs allocated to each purpose are shown in the tables on pages 58 and 60.

Cost Sharing

Installation costs will be shared by the local sponsoring organizations and the Federal Government in accordance with the requirements of Public Law 566 as amended, and the Secretary's Policy Statement.

Land Treatment Measures

Installation costs, other than technical assistance, are estimated to be $160,050. These costs will be borne by the individual landowners with such assistance as may be available from the Agricultural Conservation Program or other sources of funds.

The costs of accelerated technical assistance necessary to speed up installation of land treatment measures (estimated to be $35,620) will be paid from P.L. 566 funds. Cost of technical assistance listed under "other funds" is at a rate now being expended for the going program. Cost of this program is estimated to be $2,400 and will be borne by the regular appropriations of the Soil Conservation Service.

Structural Measures

The following costs will be borne by P.L. 566 funds:

1. All construction costs allocated to flood prevention, and 50 percent of construction costs allocated to irrigation and recreation.

2. All installation service costs allocated to flood prevention, irrigation, and recreation, except those for the recreational facilities associated with the Cooper Creek Reservoir, for which P.L. 566 funds will bear not more than 50 percent of payments made for required private consulting engineering and architectural services. Service personnel will assist, as available, on site locations, designs, and supervision of construction of the recreational facilities.

3. Fifty percent of the cost, excluding legal and administrative costs for acquiring the land rights in Cooper Creek Reservoir allocated to recreation.

The following costs will be borne by other funds:

1. All construction costs allocated to municipal and industrial water, and 50 percent of construction costs allocated to irrigation and recreation.

2. All installation service costs allocated to municipal and industrial water and 50 percent of payments made for required private consulting engineering and architectural services for the recreational facilities associated with the Cooper Creek Reservoir. Regular employees of the sponsors will take leadership on site locations, designs, supervision of construction, and other installation services needed for installation of the recreational facilities.

3. Fifty percent of the cost of the land rights for Cooper Creek Reservoir allocated to recreation.

4. All costs of land rights for all other purposes.

5. All engineering, legal or administrative costs for acquisition of land rights.

6. Contract administration costs.

All costs allocated to municipal and industrial water will be paid by other funds. However, under the authorization of P.L. 566 as amended, authorizing the use of Federal funds for including storage capacity to meet future needs, P.L. 566 funds will be used to pay all construction and installation services costs for this purpose. These funds will be repaid by the sponsors within fifty years of the installation date.

Obligation of Funds by Fiscal Years

P.L. 566 Funds	1965 $	1966 $	1967 $	1968 $	1969 $	1970 $
Installation Services	7,350	79,510	39,850	14,060	550	-
Construction	-	245,440	206,795	-	-	-
Land, Easements, R/W	-	16,380	-	-	-	-
Technical Assistance	2,000	10,000	10,000	8,000	4,000	1,620
Total P.L. 566	9,350	351,330	256,645	22,060	4,550	1,620
Other Funds						
Installation Services	500	8,000	3,500	1,200	100	-
Construction	-	61,120	166,195	-	-	-
Land, Easements, R/W	11,100	121,670	39,850	-	-	-
Contract Admin.	-	3,400	2,840	1,010	-	-
Land Treatment	10,000	40,000	60,000	25,000	16,000	6,650
Technical Assistance	120	480	480	480	480	360
Total Other Funds	21,720	234,670	272,865	27,690	16,580	7,010

EFFECTS OF WORKS OF IMPROVEMENT

Land Treatment Measures

The effects of land treatment measures will be primarily on-site conservation benefits of land improvement and efficient water management. These measures will also have a limited effect on the floodwater and sediment damages. These land treatment measures must be installed before the full benefits can be realized from the structural measures.

It is estimated that the land treatment measures above the Cooper Creek Reservoir will reduce the sediment accumulation in this reservoir by 450 cubic yards per year (25 percent of present annual yield).

The land treatment measures below the reservoir will allow improved management and use of the land. These measures will facilitate removal of excess surface or subsurface water, establish improved species of forage, and distribute and apply irrigation water efficiently.

Structural Measures

Flood Prevention

The project measures are designed to eliminate the damages from the smaller and more frequent floods. The flows from the larger and less frequent events will be reduced by 40 percent to 50 percent thereby preventing most of the flooding and materially reducing damages. Average annual floodwater damages will be reduced by approximately 95 percent.

Above the City of Sutherlin the measures will provide for flood prevention up to and including the 10 percent chance event. In the City of Sutherlin the measures will contain the flows of a 2 percent chance event within banks. Below the City of Sutherlin the measures are designed so that the flows from the 10 percent chance event will not remain out of the streambanks longer than 24 hours.

The relief from annual flooding in the agricultural areas of this watershed will allow proper soil management and cropping practices to be utilized and will stimulate a more stable agricultural program. More intensive land use will be possible on 1,080 acres of cropland.

The City of Sutherlin will be relieved of the regular hazard of flood damaged homes and businesses and disrupted community affairs whenever heavy rains occur. This will stimulate the repair and replacement of many dwellings and business buildings and encourage new construction and development.

The structural measures above the Cooper Creek Reservoir will prevent previously stabilized sediment deposit areas from being removed by stream erosion and reduce the inflow of sediment and debris to the reservoir.

Cooper Creek and Plat I Reservoirs will intercept 1,350 and 2,945 cubic yards of sediment per year respectively. These volumes are, hence, not available for downstream deposition and, in addition, the water quality will be significantly improved.

Reduced stream velocities on Cooper Creek and Sutherlin Creek will provide stable conditions along the channel banks and bed.

Irrigation Water Management

Areas to be served by project irrigation water are adjacent to Sutherlin Creek from the reservoir downstream to the east city limits of Sutherlin.

It is expected that all lands will be irrigated with sprinklers by pumping directly from stations along the creek. Water will be delivered to approximately 20 operating units for irrigation of 330 acres. The irrigated acreage per unit will vary from one to 30 acres and average approximately 16 acres per unit.

The major intensification of land use resulting from this project will be on 330 additional acres of irrigated land. This land is now used for production of hay, pasture, and dryland orchards. Cropping pattern for the irrigated land will be 60 percent improved pasture, 25 percent improved hay, and 15 percent orchards. It is estimated that average net farm income per acre will be increased by $27.35. Details of cropping program and income are shown in the investigation and analyses section. There will be no new land brought into cultivation or converted to production of surplus crops as a result of this project.

Flood protection and irrigation will encourage an increase in acreage of crops like this well managed grass and legume pasture

Non-Agricultural Water Management

Recreation

The waters of Cooper Creek Reservoir will be the chief recreational asset of the area. This will provide an opportunity for many people to use an attractive, well maintained and regulated recreational development of a type not now available in this area. The reservoir will provide opportunities for boating, fishing, water skiing, swimming, skindiving

hiking, picnicking, and sightseeing. The scenery here is attractive and will improve as the regrowth of timber develops on the surrounding hills. Access to the recreational facilities from the main routes of travel will be through the City of Sutherlin. This will increase business related to picnicking, boating, and fishing supplies and will bring in more customers for the local service stations, restaurants, and tourist facilities.

Water-based recreation provides enjoyment for the whole family

Municipal and Industrial Water

Two hundred acre feet of storage capacity in Cooper Creek Reservoir will be included for municipal-industrial water for the City of Sutherlin. This supply will provide the water supply needed to meet the demands of planned industrial and population growth and allow for an orderly development of this community.

Public Health

The orderly removal of floodwater will assist in the control of pollution and mosquito control in this area and reduce the hazard of diseases related to flooded and under-developed areas.

Fish and Wildlife Habitat

The fishery development possibilities of Cooper Creek Reservoir lie in the expected ability of the proposed reservoir to support a substantial resident fishery under a management program of the Oregon State Game Commission. The operation of the reservoir will not materially affect seasonal flows in Cooper Creek below the dam except during the winter when in periods of high flow the storage of industrial and municipal water is being replaced. This replacement will be scheduled so that downstream aquatic environment will be maintained. By poisoning trash fish in the stream tributary to the reservoir, and screening of diversion at the dam, the reservoir can be maintained as a trout or warm water game fishery. No fish passage facilities for migratory fish will be necessary.

Upstream migrating Sutherlin Creek fish will be provided winter and early spring passage through the Plat I Dam outlet structure and the unfilled reservoir to upstream spawning areas. Downstream migrating juveniles will pass the same route until late spring storage begins, at which time they will be excluded from the reservoir by a downstream migrant trap installed at or near an existing water diversion structure at the head end of the reservoir. Those collected will be transported to below the reservoir by mechanical means. The use of the reservoir for a fishery is not a planned purpose, but determination of water quality after construction may permit an early season, put-and-take trout fishery.

Channel improvement work and the transportation of irrigation waters and irrigation return flows in Sutherlin Creek are not expected to significantly affect the present fishery productivity. During construction of the project, safeguards written into the construction contract will be followed to minimize interference with fish populations.

The project is not expected to have any significant effect on other wildlife resources of the area. It is anticipated that a small loss of upland-game and fur-animal habitat would result from channel improvement, diking, and inundation by the reservoirs. This loss would be compensated for by increased upland-game habitat around the reservoirs and increased waterfowl habitat, particularly in Plat I Reservoir site.

PROJECT BENEFITS

Land Treatment Measures

The majority of the benefits from land treatment measures will be on-site conservation benefits from land improvement and efficient water management. Land treatment measures above Cooper Creek Reservoir will reduce sedimentation in the reservoir by 25 percent and protect the quality of the water supply. Average annual off-site benefits from a reduction of sediment damages are estimated to be $180.

Structural Measures for Flood Prevention

Primary flood damage reduction benefits, both direct and indirect, will be $21,920 annually. These benefits stem from the two multiple purpose reservoirs and the channel improvement work. Additional benefits of $6,970 will accrue to these works of improvement from more intensive land use.

Structural Measures for Agricultural Water Management (Irrigation)

Estimated annual primary benefits from irrigation measures, with associated costs deducted, will be $9,030.

Structural Measures for Recreation

The Cooper Creek Reservoir and its associated recreational facilities will provide the project recreation benefits. This development will have day-use facilities for picnicking, swimming, boating, and fishing. Estimated annual use of these facilities will be 30,000 visitor-days. Estimated annual benefits at one dollar per visitor-day will be $30,000.

Structural Measures for Municipal and Industrial Water

Two hundred acre feet of capacity will be provided in the Cooper Creek Reservoir for storage of water for future municipal and industrial use. Annual benefits after such use begins, with transmission treatment and other costs deducted, will be $4,290.

Unevaluated Benefits

The installation of the coordinated watershed plan of land treatment and structural measures will provide substantial secondary benefits which have not been included in the benefit:cost analysis. The installation of the land treatment and structural measures will help encourage additional interest in conservation of the resources of the watershed and help to stabilize the economy of this community. This, in turn, will encourage further capital improvements, increase employment, help maintain a higher standard of living, and contribute to the general welfare of the community and the State.

COMPARISON OF BENEFITS AND COSTS

The ratio of average annual primary benefits ($72,210) to the average annual cost of these measures ($42,155) is 1.7:1. This ratio is based upon current prices for installation costs and long term prices for benefits, operation and maintenance.

Average annual costs, benefits, and comparison of benefits and costs, are shown in Tables 4, 5, and 6.

PROJECT INSTALLATION

Installation Period

The structural measures will be installed progressively within a 5 year period. Maximum project benefits will not be realized until all works of

improvement have been installed. However, systematic scheduling of interrelated structures will result in increasing benefits during the installation period.

The scheduled obligation of funds shown on page 22 is based upon the following proposed construction schedule:

Item	Fiscal Year Initiated	
	Installation Serv.	Construction
Channel Improvement	1965	1965
Plat I Reservoir	1965	1966
Cooper Creek Reservoir	1965	1966
Diversion Dams	1965	1966
Clearing and Snagging) Grade Stabilization Struct.)	1965	1965

Responsibilities for Installation

Land Treatment Measures

The installation of land treatment measures will be the responsibility of the individual landowners or operators with such financial assistance as may be available through the Agricultural Conservation Program or other funds.

Technical assistance will be furnished to landowners or operators through the North Douglas Soil and Water Conservation District by the Soil Conservation Service to assure the installation of the land treatment measures necessary to protect the watershed, prevent sediment deposition damage to structural measures, and to obtain the project benefits for flood prevention and irrigation. Accelerated technical assistance above the rate available under the going program will be provided from P.L. 566 funds.

Most of the land treatment measures will be installed concurrently with the installation of the structural measures.

Structural Measures

Federal assistance for carrying out the works of improvement as described in this work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666) as amended. Under this authority the Soil Conservation Service will provide installation services including surveys, site investigations, layout, design, preparation of plans and specifications, consultation, and construction inspection for the installation of structural measures.

A small acreage under the administration of the Bureau of Land Management will be required for the Cooper Creek Reservoir development. Use of this land will be obtained under a special permit for occupancy obtained by the sponsors from the Bureau. The sponsors have discussed the method and requirements for obtaining this permit with officials of the Bureau and representatives of the Bureau have attended several watershed meetings where this matter was discussed and they have assured the sponsors of the cooperation of their agency.

The Sutherlin Water Control District will have the sponsoring local organization responsibility for all structural measure installation obligations, except for the recreational facilities associated with Cooper Creek Reservoir which shall be the responsibility of the County of Douglas.

The following minimum conditions shall be met before issuance of invitations to bid on any portion of construction:

1. The necessary land easements, rights-of-way (including public access to the multiple-purpose reservoir) and the relocation of utilities will be assured by the local organizations before P.L. 566 financial assistance is made available.

   The Sutherlin Water Control District, City of Sutherlin, and Douglas County, all have sufficient legal authority, including the power of eminent domain, and agree to use such authority if necessary to acquire all of the land, easements, and rights-of-way needed for the project measures assigned to their responsibility, and therefore, Federal assistance for construction may be provided before all easements and rights-of-way for the project are obtained. In such cases, specific agreement on the obtaining of all necessary land, easements and rights-of-way shall be reached, and the willingness of the local organization to exercise their authority reaffirmed prior to execution of a project agreement.

2. Before execution of a project agreement on a structural measure having capacity for future municipal and industrial water, the local organization must execute an agreement for repayment approved by the Farmers Home Administration.

3. Mutual agreement on the schedule for construction and on plans and specifications shall be reached. Terms of contracts and all matters pertaining to contracts or to the works of improvement shall be mutually satisfactory and in accordance with requirements of the sponsoring organization and in agreement with Soil Conservation Service technical and administrative specifications.

4. Full conformance with State and Federal laws and regulations shall be the responsibility of the local interests, shall be secured with no expenditure of P.L. 566 funds, and reasonable evidence of conformity shall be presented to the mutual satisfaction of all parties.

5. Agreements for the operation and maintenance of the structural measures to be installed shall be secured.

FINANCING PROJECT INSTALLATION

Project installation costs allocated to P.L. 566 funds will be paid from funds appropriated under the authority of P.L. 566, 83d Congress; 68 Stat. 666 as amended. This work plan does not constitute a financial document for obligation of Federal and other funds. Financial or other assistance to be furnished by the Service in carrying out the plan is contingent on the appropriation of funds for this purpose.

Land Treatment Measures

The construction cost of land treatment measures will be borne by the individual landowners or operators with such financial assistance as may be available from the Agricultural Conservation Program or other funds.

Technical assistance will be provided by the Service, by going program funds at the same rate as now being provided and from P.L. 566 funds for accelerated assistance in excess of the going program rate.

Structural Measures

The project structural installation costs allocated to other than P.L. 566 funds will be the responsibility of the local sponsoring organizations as follows:

"Other" funds share of the costs allocated to flood prevention and irrigation shall be borne by the Sutherlin Water Control District. This district is established under State law and was formed primarily to plan, install, and maintain these aspects of the Sutherlin Watershed Project. The district owes no money for capital improvements at this time, and has only minor current obligations incurred in district formation and preliminary planning activities. The district has indicated that they will apply for a loan of approximately $250,000 from the Federal Government under provisions of P.L. 566 to meet project costs allocated to the district. Representatives of the Farmers Home Administration have participated in meetings of the district and have been informed by letter of the district's intention to request a P.L. 566 loan. The district will repay this loan and obtain necessary funds for operation, maintenance, and replacement, from assessments based on an appraisal of benefits received from flood prevention and on contracts for delivery of irrigation water.

Costs allocated to municipal-industrial water supplies will be borne by the City of Sutherlin. The city, by letter (see copy of letter in Investigation and analyses section) specified their interest and responsibility in this purpose and has requested that costs of construction and installation services allocated to this purpose and to the City of Sutherlin be advanced from P.L. 566 funds in accordance with the amendments to P.L. 566 passed by Congress in 1962, and that the repayment by Sutherlin be deferred 10 years to meet the timetable for projected future needs. Prior to expiration of the 10-year period (or sooner if use of the water begins before 10 years) the city will repay the advance.

Costs allocated to the sponsors for the installation of recreational facilities will be the responsibility of the County of Douglas. The County Court will schedule funds in their annual operating budgets to meet their responsibilities for all installation costs to be borne by the county for these measures. Douglas County will enter into an agreement with the water control district for sharing of recreation costs for installation of the Cooper Creek Reservoir.

The State Game Commission has participated in the development of this plan and has informed the sponsors that, subject to availability of funds,

the Game Commission will share in the installation costs for the Cooper Creek Reservoir to the extent that use of State funds can be justified to assist in the development of a resident fishery.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be operated and maintained by landowners and operators in accordance with individual conservation farm plans under cooperative agreement with the North Douglas Soil and Water Conservation District. Technical assistance will be provided by the Soil Conservation Service through their going program of assistance to soil and water conservation districts.

Structural Measures

Inspections of all works of improvement will be made at least annually, and after floods, by representatives of the Soil Conservation Service and the sponsoring organizations responsible for operation and maintenance of specific works. These inspections will be made to determine maintenance and replacement work to keep the structural measures functioning properly.

Specific maintenance agreements between the Soil Conservation Service and the responsible local organization, covering each phase of operation and maintenance, will be executed before each project agreement is signed.

It is agreed that representatives of the Federal, State, and County Governments shall have free access at all times to the structural works of improvement for official activities. All phases of operation and maintenance of these facilities shall comply with applicable local, State, and Federal regulations.

The operation and maintenance of the structural elements of the project, with the exception of the recreational facilities and the municipal-industrial water supply outlet associated with Cooper Creek Reservoir, will be the responsibility of the Sutherlin Water Control District.

Operation and maintenance responsibilities of the sponsoring organizations are as follows:

Sutherlin Water Control District

The Sutherlin Water Control District will obtain easements or rights-of-way that allow access for operation and maintenance of all the proposed facilities of this project. Funds for carrying out operation, maintenance, and replacement of the structures will be obtained from assessments by the water control district for that purpose.

Operation of the facilities shall include, but not be limited to, the following:

1. Regulating of control gates and fish trapping facilities at Plat I Reservoir according to seasonal irrigation flood detention, and fishery management requirements.

2. Installing and removing flashboards from the irrigation diversion structures in Sutherlin Creek.

3. Inspecting, cleaning, lubricating, adjusting, and otherwise servicing all controls, gates, valves, and other mechanical portions of project structures.

Maintenance of the facilities shall include, but not be limited to:

1. Keeping all structures in serviceable condition by making repairs or replacements as needed.

2. Maintaining adequate capacity in natural and constructed channels necessary for flood prevention by controlling weeds and undesirable tree growth, removal of sediment accumulation, and removal of debris jams. It is particularly important that debris removal be accomplished prior to or during project construction in natural channels in the flood plain.

3. Maintaining protective vegetative cover where needed.

4. Removing of sediment from Plat I Reservoir whenever the accumulated sediment exceeds the capacity (90 acre feet) reserved for this purpose.

The Oregon State Game Commission will, by agreement with the water control district, participate in the operation and maintenance of the fishery at Cooper Creek Reservoir, and assist in development of a plan to operate the fish passage facilities at Plat I Reservoir. This agreement will include such items as consultation with State fishery agencies on dates of gate closure and fish screen installation or removal. Since conditions may change in the future, the operation and maintenance agreement will be flexible enough to permit mutually acceptable revisions.

The Oregon State Marine Board will be requested to make special boat use regulations, such as speed limits, time limits, zoning of use areas, etc., for the Cooper Creek Reservoir as necessary for the safety of the public and to insure the compatability of fishing and other aquatic sports such as boating and water skiing.

City of Sutherlin

The City of Sutherlin will operate and maintain the municipal water supply outlet works at Cooper Creek Dam.

Douglas County

The County of Douglas will operate and maintain the recreational facilities associated with Cooper Creek Reservoir, including the access road.

This recreational development including the reservoir and associated recreational facilities will be operated for the use of the general public. The sponsors agree that all lands on which cost sharing is provided will not be sold or disposed of for the evaluated life of the project (100 years),

except to a public agency which will continue to maintain and operate the recreational development in accordance with the O & M agreement. Operation of these facilities will include the necessary custodial, policing, sanitation, and safety services.

Maintenance of the recreational facilities shall include, but not be limited to, keeping the facilities, sites, roads, parking areas, and boat launching ramps in serviceable condition by making repairs and replacements as needed. Operation and maintenance funds will be provided from regular revenue sources by the County of Douglas.

Estimated Annual Operation, Maintenance & Replacement Costs

Dollars 1/

Structure	Operation	Maintenance & Replacement	Total Annual O.M.&R.
	$	$	$
Plat I Reservoir	755	485	1,240
Cooper Creek Reservoir	585	1,580	2,165
Recreational Facilities	900	1,620	2,520
Stream Channel Improvement	-	3,100	3,100
Diversion Dams	420	85	505
Grade Stabilization Struc.		15	15
Clearing & Snagging - included with stream channel improvement			
Total			$ 9,545

1/ Long term price level

TABLE 1 - ESTIMATED PROJECT INSTALLATION COSTS

Sutherlin Creek Watershed, Oregon

Installation Cost Item	Unit	Number	Cost (Dollars) 1/ Non-Federal Land		
			P.L.566	Other	Total
Land Treatment					
Soil Conservation Service					
Cropland	ac.	2,000	-	155,250	155,250
Woodland	ac.	940	-	2,400	2,400
Technical Assistance			35,620	2,400	38,020
TOTAL LAND TREATMENT			35,620	160,050	195,670
STRUCTURAL MEASURES					
Soil Conservation Service					
Mult. Purpose Reservoir	no.	2	309,495	171,685	481,180
Recreational Development	no.	1	50,630	50,630	101,260
Stream Channel Improv.	ft.	21,400	80,460	-	80,460
Diversion Structure	no.	10	5,000	5,000	10,000
Grade Stabiliz. Struct.	no.	1	5,050	-	5,050
Clearing & Snagging	ft.	700	1,600	-	1,600
Subtotal-Construction			452,235	227,315	679,550
Installation Services					
Soil Conservation Service					
Engineering Services			101,730	13,300	115,030
Other			39,590	-	39,590
Subtotal-Installation Services			141,320	13,300	154,620
Other Costs					
Land, Easements & Rights-of-way			16,380	172,620	189,000
Contract Administration			-	7,250	7,250
Subtotal - Other			16,380	179,870	196,250
TOTAL STRUCTURAL MEASURES			609,935	420,485	1,030,420
TOTAL PROJECT			645,555	580,535	1,226,090

1/ 1963 price base

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TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of work plan preparation)

Sutherlin Creek Watershed, Oregon

Measures	Unit	Applied to Date	Total Cost (Dollars) 1/
LAND TREATMENT			
Drainage main or lateral	feet	400	20
Fish pond stocking	number	2	50
Irrigation system sprinkler	number	2	3,900
Irrigation storage reservoir	number	2	1,600
Pasture & hayland planting	acres	600	43,800
Streambank protection	feet	600	600
Tile drain	feet	1,350	405
Tree planting	acres	16	990
Total - Land Treatment			51,365
STRUCTURAL MEASURES			
Irrigation storage reservoir	number	1	12,500
Stream channel improvement	feet	50,720	31,340
Irrigation regulating reserv.	number	3	6,990
Diversion structure	number	1	2,990
Total - Structural Measures			53,820
TOTAL			105,185

1/ 1963 price base

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TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION
Sutherlin Creek Watershed, Oregon

(Dollars) 1/

	Installation Cost - P.L. 566 Funds					Installation Cost - Other Funds					Total Instal. Cost
	Construction	Instal. Services Engineering	Instal. Services Other	Easements & R/W	Total P.L. 566	Construction	Instal. Services	Adm. of Contracts	Easements & R/W	Total Other	
Plat I Reservoir											
Irrigation Outlet Gate	60	25	5	-	90	70	-	-	-	70	160
Remaining Costs	103,730	20,675	8,045	-	132,450	11,050	-	1,560	149,850	162,460	294,910
Total Plat I Reservoir	103,790	20,700	8,050	-	132,540	11,120	-	1,560	149,850	162,530	295,070
Cooper Creek Reservoir											
Municipal Water Outlet	-	-	-	-	-	10,000	2,500	-	-	12,500	12,500
Fish Screens	650	265	35	-	950	650	-	-	-	650	1,600
Fencing	3,000	1,000	500	-	4,500	3,000	-	-	-	3,000	7,500
Remaining Costs	202,055	60,115	23,135	16,380	301,685	146,915	4,010	3,660	19,620 2/	174,205	475,890
Total Cooper Creek Reser.	205,705	61,380	23,670	16,380	307,135	160,565	6,510	3,660	19,620	190,355	497,490
Recreational Facilities	50,630	4,880	1,900	-	57,410	50,630	6,790	1,100	-	58,520	115,930
Stream Channel Improvement	80,460	11,900	4,830	-	97,190	-	-	750	2,750	3,500	100,690
Diversion Dams	5,000	1,800	700	-	7,500	5,000	-	100	200	5,300	12,800
Grade Stabilization Struc.	5,050	710	300	-	6,060	-	-	60	100	160	6,220
Clearing & Snagging	1,600	360	140	-	2,100	-	-	20	100	120	2,220
GRAND TOTAL	452,235	101,730	39,590	16,380	609,935	227,315	13,300	7,250	172,620	420,485	1,030,420

1/ 1963 price base

2/ Includes $3,000 for legal, administrative, and survey costs associated with land rights, also includes $240 as municipal and industrial share of land rights.

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TABLE 2A - RECREATIONAL FACILITIES

Sutherlin Creek Watershed, Oregon

Item	Units	Amount	Estimated Cost 1/
Access road	miles	2.5	71,220
Parking areas	sq. yds.	6,000	9,600
Boat ramps	number	2	1,600
Wells and pumps	number	3	1,800
Stationary tables	number	20	1,200
Portable tables	number	40	1,400
Stoves	number	30	1,050
Pit type toilets	number	6	1,800
Barricades (log)	lin. ft.	1,320	2,640
Trash barrels	number	30	150
Boat docks (floating)	number	2	1,200
Guard rail	lin. ft.	600	600
Signs (directional & entrance)	-	-	600
Clearing, grading, rocking picnic sites	-	-	1,500
Trails	lin. ft.	2,500	1,500
Booms (log and anchor)	lin. ft.	1,200	1,680
Sand (swimming beaches)	cu. yds.	30	320
Landscaping	-	-	1,400
Total Construction Cost			$ 101,260

1/ 1963 price base

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TABLE 3 - STRUCTURE DATA

MULTIPLE PURPOSE RESERVOIRS

Sutherlin Creek Watershed, Oregon

Item	Unit	Structure	
		Plat I	Cooper Creek
Drainage area	sq. mi.	9.00	4.40
Storage capacity			
Sediment	ac. ft.	90	110
Floodwater	ac. ft.	1,960	785
Recreation	ac. ft.	-	3,290
Irrigation	ac. ft.	(790)*	-
Municipal	ac. ft.	-	200
Total	ac. ft.	2,050	4,385
Between high and low stages	ac. ft.	790	-
Surface area			
Sediment pool	ac.	34	15
Floodwater pool (at E. spillway crest)	ac.	247	147
Floodwater pool (at E. spillway design flow depth)	ac.	287	151
Irrigation	ac.	(146)*	-
Recreation	ac.	-	127
Municipal	ac.	-	131
Volume of fill	cu. yds.	92,300	233,200
Elevation top of dam	ft. (m.s.l.)	595.5	675.0
Top length	ft.	1,275	400
Maximum height of dam	ft.	30.5	93.0
Emergency spillway			
Crest elevation	ft. (m.s.l.)	590.0	670.5
Bottom width	ft.	120	120
Type	type	earth	earth
Percent of use	percent	1	1
Ave. curve no. - Cond. II	number	87	82
Emergency spillway hydrograph			
Storm rainfall (6 hr.)	inches	7.00	7.00
Storm runoff	inches	5.48	4.91
Velocity of flow (V_c) 1/	ft./sec.	6.5	4.6
Discharge rate 1/	c.f.s.	1,350	450
Max. w.s. elev. 1/	ft.(m.s.l.)	592.4	671.5

TABLE 3 (cont'd)

Item	Unit	Structure: Plat I	Structure: Cooper Creek
Freeboard hydrograph			
Storm rainfall (6 hr.)	inches	13.00	13.00
Storm runoff	inches	11.37	10.69
Velocity of flow (V_c) 1/	ft./sec.	10.3	9.1
Discharge rate 1/	c.f.s.	4,600	2,950
Max. w.s. elev. 1/	ft.(m.s.l.)	595.5	674.6
Principal spillway			
Capacity-low stage	c.f.s.	126	-
Capacity-high stage	c.f.s.	316	150
Capacity equivalents			
Sediment volume	inches	0.19	0.47
Detention volume	inches	4.08	3.35
Spillway storage	inches	3.44	3.05
Class of structure		"c"	"c"

* Joint use with floodwater

1/ Maximum during passage of hydrograph

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TABLE 3A - STRUCTURE DATA

CHANNELS

Sutherlin Creek Watershed, Oregon

Channel Designation	Stations for Reach: From Sta. (100 ft)	To Sta. (100 ft)	Watershed Area (sq.mi.)	Planned Channel Capacity (cfs)	Average Bottom Width (ft.)	Average Side Slope	Average Depth (ft.)	Average Grade (pct.)	Average Velocity (fps)	Volume of Excavation (c.y.)
Sutherlin Creek	113	146	41.18	3,000	30	2:1	9.5	0.20	6.6	33,000
Sutherlin Creek	408	452	16.40	1,600	25	2:1	7.0	0.20	6.2	6,500
Sutherlin Creek	500	516	14.50	640	14	2:1	5.0	0.32	5.3	6,000
Cooper Creek	3	42	6.85	650	12	2:1	5.5	0.31	5.3	4,500
Waite Street	0	12	0.52	150	4	1.5:1	5.0	0.10	2.5	2,600
Camas Swale	0	70	2.45	210	4	2:1	4.0	0.35	4.2	12,400
Total		21,400 ft.								65,000

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TABLE 4 - ANNUAL COST

Sutherlin Creek Watershed, Oregon

(Dollars)

Evaluation Unit	Amortization of Installation Cost 1/	Operation and Maintenance Cost 2/	Total
Plat I Reservoir (w/div. dams & misc. channels)	10,990	3,235	14,225
Cooper Creek Reservoir (w/rec. facil., channel improv., grade stabiliz. struct., & clearing & snagging)	19,750	5,100*	24,850
Channel near Wilbur	1,870	1,210	3,080
Total	32,610	9,545	42,155

1/ Current price amortized for 100 years at 3%

2/ Long term price level

* Includes 2,520 for operation, maintenance and replacement of recreational facilities

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Sutherlin Creek Watershed, Oregon

(Dollars) 1/

Item	Average Annual Damage: Without Project	With Project	Damage Reduction Benefit
Floodwater and Sediment			
Crop and pasture	2,510	390	2,120
Other agricultural	2,870	440	2,430
Non-agricultural			
Residential	2,750	30	2,720
Commercial	8,250	80	8,170
Roads and bridges	3,450	30	3,420
Subtotal	19,830	970	18,860
Indirect	3,290	110	3,180
Total	23,120	1,080	22,040

1/ Long term price level

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Sutherlin Creek Watershed, Oregon

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/						AVG. ANNUAL COST	BENEFIT COST RATIO
	Flood Prevention		Ag.Wt.Mgmt.	Non-Ag. Water Mgmt.		Total		
	Damage Reduction	More Intensive Land Use	Irrigation	Recreation	Municipal & Industrial			
Plat I Reservoir (with misc. chan. & div. dams)	13,910	3,620	9,030	-	-	26,560	14,225	1.9:1
Cooper Creek Reservoir (with channel imp., grade stabiliz. struc., clearing & snagging, & recreational facilities)	6,560	1,410	-	30,000	4,290	42,260	24,850	1.7:1
Channel near Wilbur	1,450	1,940	-	-	-	3,390	3,080	1.1:1
GRAND TOTAL	21,920 2/	6,970	9,030	30,000	4,290	72,210	42,155	1.7:1

1/ Long term price level

2/ In addition, it is estimated that land treatment measures will provide off-site flood damage reduction benefits of $120 annually.

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INVESTIGATION AND ANALYSES SECTION

SUTHERLIN CREEK WATERSHED

Douglas County, Oregon

December 1963

HYDROLOGY

Investigations were made to determine the peak flow characteristics, yield characteristics, and yield distribution in the area for use in planning multiple-purpose reservoirs and flood channels.

Basic Data

The Douglas County Water Resources Survey has cooperated with the Geological Survey in maintaining a staff gage and crest stage station on Sutherlin Creek in Sutherlin (14-3192) since October 1955. There are numerous geological survey gaging stations in the surrounding area with reliable streamflow records. The main records used are for Cow Creek near Azalea (14-3090) with 35 years of record, South Umpqua River near Brockway (14-3120) with 33 years of record, North Umpqua River at Winchester (14-3195) with 20 years of record, and Umpqua River near Elkton (14-3210) with 57 years of record.

The Douglas County Water Resources Survey has maintained a standard non-recording precipitation gage near Sutherlin (2ENE) at about 600 feet elevation, since March 1957 (Douglas County #57). There are Weather Bureau climatological stations in the nearby area. The principal ones are Sutherlin 14ENE (Oregon #8263) at 1,035 feet elevation (an hourly precipitation station), Idleyld Park (Oregon #4126) at 1,080 feet elevation, Winchester (Oregon #9461) at 460 feet elevation near the mouth of this watershed, and Roseburg (Oregon #7326) at an elevation of 505 feet, and 12 miles south of this watershed is a first order station with 95 years of record.

There is a forest type map of the entire area and standard soil surveys are available for the valley lands.

Peak Flows

The seven years of peak flow record on Sutherlin Creek was adjusted by means of the four long reliable records of the nearby similar streams which have an average of 35 years of record. This adjusted reliable record was then used with the other reliable records in a regional analysis of peak flows by the method of Section 2.8 of NEH-4 Supplement A. The results of this analysis were substantiated by several other methods of the Soil Conservation Service and other agencies. These studies determined the concordant relations on this watershed to be $q1\%=300A^{0.85}$ and $q50\%=100A^{0.85}$. Peak flows for channel design were developed from these concordant relationships.

Yield

Sutherlin Creek is a low elevation tributary of the North Umpqua River about 4 miles above the junction of the North Umpqua River and the South Umpqua River. Although most of the North Umpqua River Basin is a high elevation watershed with extensive areas of pumice soils which absorb large quantities of moisture during the wet winter season and release it during the summer, Sutherlin Creek is too low in elevation to maintain a winter snow pack and its soils are mostly clays with rapid surface drainage. Most of its winter precipitation runs off immediately as surface flow and relatively little water is retained and released during the summer months. Therefore, the

runoff yield and runoff patterns are directly related to the precipitation pattern and similar to those of much of the South Umpqua River Basin streams. The seven years of annual runoff record on Sutherlin Creek was adjusted to a long time yield record by means of long reliable records of nearby similar streams. The seasonal distribution used was also based on the long time average of the similar reliable streams. Annual yield frequency curves for the Plat I Reservoir and the Cooper Creek Reservoir are shown on Figure 1.

Design Hydrographs

Runoff volumes for the principal spillway hydrographs for the two proposed dams were computed by the method of SCS Technical Release #10 to meet the requirements of Engineering Memorandum SCS-27. Curves of accumulated runoff were computed from precipitation data and substantiated by the actual runoff records of Sutherlin Creek and the nearby long record reliable streams.

Emergency spillway design flows for the two proposed dams were computed by the method of Section 3:21 NEH-4, Supplement A, as defined in Engineering Memorandum SCS-27. Precipitation for developing the hydrographs was obtained from ES 1020 maps. Both dams were given a "c" classification because of their position above Sutherlin and because of the probability of developments below them. Cooper Creek Dam has a drainage area of 4.40 square miles. Elevations range from 1,914 feet to 620 feet with an average elevation of 1,040 feet. Maximum water travel distance is 3.6 miles for an overall watershed slope of 6.8 percent. Aspect is from southeast to northwest. Plat I Dam has a drainage area of 9.00 square miles. Elevations range from 1,960 feet to 580 feet with an average elevation of 850 feet. Maximum water travel distance is 4.6 miles for an overall watershed slope of 5.7 percent. Aspect is from east to west.

The results of these computations are shown in Table 3.

GEOLOGY

Foundation Investigations

An investigation was made to determine subsurface conditions on four proposed sites for storage reservoirs on Sutherlin Creek and its tributaries. The tributaries are Dimmick Creek, Cooper Creek, and Grubb Creek. The preliminary investigation included test pits and borings along the proposed dams and test pits in the reservoir areas.

At all sites the abutments consist of a silty sand over a firm bedrock of interbedded sandstones and shales that will be suitable for foundation but will require treatment to reduce leakage. The test pits in the channel areas showed alluvial deposits of silty clay to clayey silts and sand. These stratified deposits were found to depths in excess of 50 feet and will require that fill and foundation preparation be designed for high potential settlement.

It was concluded that the reservoir basins at Cooper and Plat I are satisfactory for water storage. Temporary water losses to bank storage will be recovered as return flow when the reservoir draws down. The borrow investigation showed that suitable borrow material will be available for the construction of the two proposed dams. The principal borrow can be excavated from the flood plain and from the valley slopes within the reservoir basins.

The spillway locations on all sites are underlain by relatively soft, weathered sandstone and shale.

The Plat I Reservoir will be a low dam in the flood plain area on Sutherlin Creek for the purpose of floodwater retention and storage of a limited amount of water for irrigation. The investigation of this site was limited to observation of the soil profiles in the immediate area and auger holes drilled along the centerline in the channel area.

The subsurface investigation of the Cooper Creek site was limited to two auger holes drilled to 20 and 45 feet. These holes were correlated with deep borings on two alternate centerlines immediately upstream from the present site to obtain projected bedrock information.

Since Sutherlin Creek and its tributaries are practically dry during the late summer months, the availability of water for construction use will depend upon the time of year in which any of the dams are built. Construction during the months of July and August would make it necessary to obtain water from sources outside of the watershed.

On the basis of these investigations, foundation conditions at each site are considered satisfactory for the structures as planned. However, a complete subsurface investigation will be required in the installation phase to provide detailed data for final design.

Channel

The geologic evaluation included subsurface investigation to determine bank stability and allowable velocities along the Sutherlin and Cooper Creek channels. The materials were examined by channel sampling of bankcuts and bottom exposures. Undisturbed samples were taken of each soil type for laboratory testing.

Units exposed along the channel banks and bottom were (1) Anlauf series, clayey soils of low plasticity; (2) Drain series, clayey silts with fairly high plasticity; and (3) sandy gravels with some cementation. The D_{75} of the gravels is 1.7 inches. Laboratory tests and size analyses were made to provide data for stream channel design for soils along the proposed channel improvement reaches. The strength of the Anlauf soils is moderately low, hence they would be susceptible to erosion under conditions of high sustained velocities.

Sedimentation

A field survey was made of sedimentation conditions in the watershed. Particular attention was directed to determination of sediment deposition in the stream channel, sediment damages from periodic overflow deposition, and reservoir sedimentation. The survey indicated that the flood plain has received little damage from overflow deposition.

Sediment deposition in the two proposed reservoirs was also appraised. Data for this determination were derived from the results of sediment load samplings by the Douglas County Water Resources Board and from visual observations made of the watershed basin and slopes.

It was concluded that the annual sediment production from above the Cooper Creek site will be 1.1 acre feet or 110 acre feet over a 100 year period. Sediment production from above the Plat I Reservoir is estimated to be 1.8 acre feet annually or 180 acre feet in 100 years.

In cooperation with the U.S. Forest Service, a visual examination was made of the upper watershed with particular concentration on the upper Cooper Creek area. A recent fire resulted in almost complete destruction of the existing timber and other vegetative cover on a large portion of the Cooper Creek watershed. The bare slopes either have been or will be subjected to a very severe erosion unless adequate protective measures are undertaken. Stabilization measures to prevent further degradation and bankcutting will be essential on the small tributary stream flowing from this area.

ENGINEERING

Surveys and Other Data Used in Planning

The following engineering surveys and data were used in developing data for planning the structural measures proposed in this plan and of the alternate structural measures considered:

1. "Plan and Profile of Sutherlin Creek Area Proposed Channel Improvement" by Corps of Army Engineers.

2. Plan, profiles, and cross sections of Cooper Creek, Sutherlin Creek, and tributaries to supplement the Corps of Army Engineers' data.

3. Topographic surveys with 10-foot contour intervals on Cooper Creek Reservoir, Upper Sutherlin Creek Reservoir, Dimmick Reservoir, and Grubb Reservoir.

4. Topographic survey to a 5-foot contour interval of Plat I Reservoir.

5. A level network of the flood plain area and reservoir sites using a mean sea level datum.

Design and Operation of Structural Measures

Plat I Multiple-Purpose Reservoir

This structure was designed using criterion for a class "c" structure as defined in SCS Engineering Memo 27. The earthfill dam will have a maximum height of 30.5 feet, top length of 1,275 feet, and provide a reservoir with a capacity of 2,050 acre feet of water at the emergency spillway crest elevation.

The capacity of the principal spillway was limited to 316 c.f.s. when the reservoir water surface is at the emergency spillway crest elevation. Larger releases would cause the 2 percent chance peak flows to overflow the channel banks in Sutherlin.

The emergency spillway will be constructed in earth around the right end of the dam. The width of the spillway is 120 feet with a total depth from the crest to the top of the dam of 5.5 feet. Dimensions of the emergency spillway were determined by routing the "emergency spillway" and "freeboard" inflow hydrographs through the principal spillway and reservoir by Method No. 2, Section 5, of the National Engineering Handbook. The reservoir water surface was considered to be at the level of the principal spillway crest to start routing of the hydrographs. The total spillway capacity to the top of the dam is 4,600 c.f.s. with spillway storage of approximately 1,650 acre feet.

The capacity required for flood detention storage was determined in accordance with procedures outlined for multiple day storms in SCS Technical Release No. 10. The elevation of the emergency spillway crest was determined from the one percent chance accumulative runoff curve.

The land to be irrigated is adjacent to Sutherlin Creek immediately downstream from the reservoir. The acreage that can be provided a full season irrigation supply was determined by analyzing monthly inflow to the reservoir, reservoir evaporation and seepage, and gross irrigation requirements. The distribution of annual yield was used to determine inflow. The monthly reservoir evaporation was computed from maps in Chapter 9, NEH-4. Seepage was estimated to be 0.5 percent of storage remaining at the month's end. The net irrigation requirement was determined using a modified Blaney-Criddle method. The seasonal requirement for clover-grass with a 2 inch depletion at the end of the irrigation season was 19.45 inches. For irrigated pears, it was 14.97 inches with a 2.3 inch depletion at the end of the season. Weighted net irrigation requirement is 18.77 inches. The composite crop net irrigation requirement was adjusted for 70 percent sprinkler application efficiency, 10 percent conveyance and operation losses, and reservoir evaporation and seepage to determine gross irrigation storage requirement.

The principal spillway was designed to allow upstream passage of anadromous fish. The barrel slope was set so that velocities of 8 feet per second or less will occur when the depth of flow is less than one foot. The Oregon State Game Commission provided design specifications for the trapping facilities included for downstream migrating fish.

Douglas County Road Department provided design criterion for the road relocation work. The relocation was designed to provide a road of equal utility to that now existing. Those sections of existing road below elevation 590 feet m.s.l. will be relocated.

The design for the coaxial cable relocation included in the plan represents one which would leave the cable accessible for maintenance and repair even under high water conditions and keep interruption of service on the line during the relocation to a minimum. Pacific Northwest Bell Telephone Company assisted in the design of the relocation by providing criterion and consultation.

Cooper Creek Multiple Purpose Reservoir

This structure was designed using criterion for a class "c" structure as defined in SCS Engineering Memo 27. The zoned earthfill dam will have a maximum height of 93 feet, and a top length of approximately 400 feet. The reservoir will have a capacity of 4385 acre feet at the crest of the emergency spillway.

The construction cost estimated for the dam is based upon a positive sheet piling cutoff to bedrock which is estimated to be about 50 feet, and the use of relatively flat stabilizing fills on the lower half of the embankment.

Soils mechanics tests indicate an adequate quantity of impervious materials are available from areas along the channel of Cooper Creek downstream from the dam site for one-half mile. The remainder of the fill material required for the zoned embankment can be obtained from the reservoir basin, including the sandstone-shale formation to be excavated from the emergency spillway location in the right abutment.

The maximum release rate for the principal spillway is 150 c.f.s. This release rate reflects the most economical combination of downstream channel improvement on Cooper Creek and reservoir storage to provide flood protection benefits.

The emergency spillway has a bottom width of 120 feet and a total depth of 4.5 feet from crest elevation to the top of the dam. It will not be used except by floods larger than one percent chance (100 year frequency). The "emergency spillway" and "freeboard" inflow hydrographs were routed through the reservoir and principal spillway by Method No. 2 of Section 5, NEH. The top of dam elevation was determined from the "freeboard" routing and found adequate when checked against wave freeboard requirements.

Cost Estimates

Land Treatment Measures

Estimates of quantities and costs of land and land treatment measures are based on a full study of the needs in the watershed. Estimates reflect prices and costs prevailing in the area and were taken from current records of the ACP, SCS, and other sources of local costs.

Structural Measures

Cost estimates for structural measures are based on the preliminary designs for each measure and reflect current prices for similar work in this locality. Where local cost information was not available, costs for similar construction in other areas were used after having been adjusted for local conditions by analyses of production rates and costs for equipment as affected by the availability of materials, accessibility and topography of the site and size of the structure. Data for the cost estimate for the fish trap, fish screens, fish hauling, etc., were provided by the Oregon State Game Commission. Data for the cost estimate for the road relocation and access roads was obtained from the Douglas County Road Department cost records. Pacific Northwest Bell Telephone Company assisted in the preparation of the cost estimate of the coaxial cable relocation, and the City of Sutherlin estimated the associated costs for the municipal water distribution system from records of costs for recent construction of similar items.

An analysis of the needs, costs, and benefits for recreational facilities was made by the park department of Douglas County. Included in the evaluation were studies of population, transportation, use of similar recreational facilities, and of alternate plans for size, location, and usage of facilities at this site. Estimated costs for project measures were derived from records of actual construction cost by the park department and contracts for similar facilities by state and county park departments. All costs were adjusted to reflect construction conditions at this site. Costs for access road construction were obtained from the county road department from records of current costs for construction of similar roads in this area.

Channel Improvement

Profile and cross-section surveys of the natural channels were used to locate reaches requiring enlargement and improvement. Following the February 1961 storm, a survey of the areas flooded was made and transferred to a photo mosaic of the flood plain. This survey was used as a basis for location of proposed new channel construction and also to identify reaches of existing channels requiring improvement.

The major soils traversed by the channels were sampled, tested, and analyzed for non-erosive design velocities by use of the tractive force theory. Maximum velocities occurring in existing channels were computed for the slope area method in five different reaches and compared with the analysis made by the tractive force theory. As a result of this comparative analysis, the proposed channel work is based upon velocities presently occurring in stable reaches of the channel.

The physical properties of the channel improvement and estimates of excavation quantities are shown in Table 3A.

The Waite Street channel will be new construction. The channel location is within the Waite Street right-of-way. Excavated material will be hauled from the site for disposal. Cost of a reinforced concrete box culvert under Central Avenue at the upstream end of the channel is included in the plan.

All other reaches of proposed channel improvement are in existing channels in which capacity of present bridges and culverts will be adequate. Spoil disposal will be in adjacent low areas near and along side of the channels. The design capacity on Cooper Creek is dependent upon using the excavated material for construction of low dikes along each side of the channel.

Irrigation Diversion Dams

The area to be supplied with irrigation water from storage in Plat I Reservoir is located adjacent to Sutherlin Creek from the dam downstream to the east city limits of Sutherlin--a distance of about 2 miles. Irrigation water will be released from the reservoir and pumped directly from the stream along this reach.

Ten reinforced concrete flashboard structures are planned in this reach to create pools for the pumping stations. The structures will be dimensioned to the channel width (14-foot average) to allow unobstructed flow during the winter storm season when the flashboard will be removed. The structures will be capable of checking water depths to 4 feet. Riprap will be placed at entrances and exits of structures to provide protection against scouring velocities which would endanger the structure.

Grade Stabilization Structure

This structure is located on a tributary of Cooper Creek above the Cooper Creek Reservoir (Figure 7). The standard plan for a type "B" drop structure with a controlled drop of 8 feet and width of 8 feet was used as a basis for estimating quantities of concrete and the cost of the structure. Required capacity of the structure is 180 c.f.s.

Clearing and Snagging

Areas requiring clearing and snagging are also located on tributaries of Cooper Creek above Cooper Creek Reservoir (Figure 7). Cost estimates were provided by the U.S. Forest Service and based upon costs of comparable work in other areas.

Alternate Structural Measures Considered

Reservoir sites have been surveyed and cost estimates prepared on Upper Sutherlin Creek (NW¼ Sec. 30, T25S, R4W), Dimmick Creek (SE¼ Sec. 10, T25S, R5W), and Grubb Creek (SE¼ Sec. 36, T25S, R6W).

These sites were analyzed to determine their flood protection effects on the damage area of the flood plain. Even with complete control of the watershed area at each of these sites, the peak flows from the remaining uncontrolled watershed were not reduced sufficiently in the principal damage area to preclude a major channel rehabilitation and enlargement throughout the flood plain. All of the sites are feasible when the demand for additional irrigation, recreation, municipal-industrial, or some other use would warrant development of the potential watershed yield at each site. Some remaining flood prevention benefits could be credited to these sites but are minor compared to other purposes.

ECONOMICS

Floodwater Damages

Flood damage surveys were made for three flood events. The Corps of Engineers made a damage survey after the flood of December 25, 1955. The Sutherlin Water Control District made a survey after the flood of February 10, 1961, and Soil Conservation Service personnel made a survey after the flood of November 23, 1961.

In addition to the damage survey data, a review of all available newspaper accounts of floods was made in the Sutherlin and Roseburg papers. This review covered a 14-year period beginning with 1948--a non-flood year--and ending with 1961. There were 13 floods recorded during this period.

Analysis of a typical flood was used for estimating flood prevention benefits. A damage-frequency type of analysis was considered, but not used, due to the lack of coordination between damages in Sutherlin and recorded stages or flows in Sutherlin Creek.

A summary of the newspaper accounts and damage surveys indicates that the floods fall into two general categories: (1) smaller floods that cause limited damage to roads and agricultural land, and (2) larger floods with sufficient stage to cause damages in Sutherlin, with floodwater entering places of business and closing the main street. The records indicate that, of the 13 floods occurring during the 14-year period used in this analysis, 8 floods were of the larger category and 5 were in the smaller category.

Indirect damages were calculated as a percent of the direct damages. The factors used are as follows:

Agricultural damages	10%
Residential damages	15%
Commercial damages	20%
Roads and bridges	20%

Average annual floodwater damages are estimated to be ~~$22,040~~ 23,120 (~~$18,860~~ 19,830 direct) (~~$3,180~~ 3290 indirect). Table 5 shows a detailed breakdown of these figures.

Benefits of Works of Improvement

A comparison of future conditions, with and without the project, was made. Effect of land treatment measures was considered before crediting the effect of the project structural measures.

Land Treatment Measures

Benefits from land treatment measures will be realized from watershed protection above the structural measures and on-site conservation benefits from land improvement and efficient agricultural water management.

The average annual off-site benefits of land treatment measures in the woodland areas are estimated to be $120. Studies indicated that the land

treatment program will not significantly reduce peak flows. However, it will have a marked effect on the sediment production rate and will reduce downstream sediment damages. The geologist estimates that sediment yield will be reduced by 25 percent. The treated area's pro-rated share of total sediment damages is estimated to be $490. The 25 percent reduction is equivalent to $120 average annual off-site benefits. No monetary evaluation was made of on-site benefits from land treatment measures.

Structural Measures for Flood Prevention

Flood prevention benefits are two types--benefits from reduction of floodwater damages and benefits from more intensive use of land. Flood prevention benefits, as shown in Table 5, are the difference between average annual damages that will occur without and with the project measures installed. The principal remaining damages will be the damages from the events greater than the 2 percent event.

Benefits of intensifying land use will be realized on land which is presently used for low-quality hay and pasture. With adequate flood protection this land will be improved to more productive hay and pasture. The benefits are based upon the difference between future net income per acre with and without the project structural measures installed. The yields used in this analysis were determined by interviews with farmers and agricultural agency representatives. Net returns were calculated with the use of single-enterprise crop budgets developed for this area. One thousand and eighty acres of land will have benefits, which will average $6.45 an acre. Average annual benefits of more intensive land use are estimated to be $6,970.

Structural Measures for Agricultural Water Management (Irrigation)

The project irrigation benefits are the estimated primary benefits from converting 330 acres of dry cropland to irrigated cropland. The benefit used is the difference between net farm income with and without irrigation with projected future technological and management levels.

Cost information, cropping pattern, and yield figures are based upon interviews with farmers and agricultural agency representatives, and upon data from some nearby test plots. Single-enterprise crop budgets were constructed to reflect conditions on project farms. Prices and costs were adjusted to the long-term projected level. Associated land treatment costs were deducted to obtain net project benefits.

The following tables show land use, yields, and net income with and without the project:

Irrigation Benefits

Future Conditions - Without Project

Crop	Average Yield	Price $	Net Return Per Acre $	% in Crop	Wt. Net Return Per Ac. $
Imp. Dryland Hay	2½ T	21.70/T	3.00	33-1/3	1.00
Imp. Dryland Pasture	315# beef	18.00/cwt.	12.20	66-2/3	8.15
Total					9.15

Future Conditions - With Project

Irrigated Hay	4½ T	24.50/T	15.80	25	3.95
Irrigated Pasture	675 lbs.	18.00/cwt.	37.75	60	22.65
Irrigated Pears	375 bxs.	1.95/box	166.55	15	25.00
Total					51.50
Increase in income per acre					42.35
Associated irrigation costs per acre					15.00
Project irrigation structural measures benefit per acre					27.35
Total Annual					$9,030.00

Structural Measures for Recreation

All recreation benefits accrue from installation of the Cooper Creek Reservoir and associated recreational facilities. The annual usage estimate, made by the Douglas County Park Department, was based upon a study of the use of similar parks elsewhere in Oregon. This study included a tabulation of size, type of facilities, relationship to water, and visitor-day usage. All parks included in the analysis are public owned and operated. This estimate of 30,000 visitor-days was reviewed and approved by the Douglas County Court.

The annual benefits are estimated to be $30,000.

Structural Measures for Municipal and Industrial Water

The City of Sutherlin has requested 200 acre-feet of storage in Cooper Creek Reservoir. Benefits were estimated from data supplied by the Superintendent of Public Works, City of Sutherlin. The average annual benefits of $4,290 are based upon the present charge for water. Benefits were discounted 10 years to allow time for development of the use for this water and are the net benefits remaining after the deduction of all associated costs.

Sutherlin Creek Watershed

Plat I Reservoir

Capacity and Cost Allocation

Capacity	Acre Feet	Percent
Flood Prevention		
Single purpose (includes sediment)	1,260	
Joint use (½ of 790 used also for irrigation)	395	
Total Flood Prevention	1,655	80.7
Irrigation		
Joint use (½ of 790 ac. ft. also used for flood prevention)	395	19.3
Total	2,050	100

Costs	Flood Prevention $	Irrigation $	Total $
Specific Costs			
Irrigation outlet (construction)	-	130	130
Installation services	-	30	30
Remaining Costs			
Construction	92,680	22,100	114,780
Installation services	23,190	5,530	28,720
Contract Administration	1,260	300	1,560
Land, easements, & rights-of-way	121,000	28,850	149,850
Total	238,130	56,940	295,070

Sutherlin Creek Watershed

Plat I Reservoir

Cost Sharing

	P.L. 566 Funds $	Other Funds $	Total $
Flood Prevention			
Joint Costs			
Construction	92,680	-	92,680
Installation services	23,190	-	23,190
Contract administration	-	1,260	1,260
Land, easements & rights-of-way	-	121,000	121,000
Total	115,870	122,260	238,130
Irrigation			
Specific Costs			
Irrigation Outlet			
Construction	60	70	130
Installation services	30	-	30
Joint Costs			
Construction	11,050	11,050	22,100
Installation services	5,530	-	5,530
Contract administration	-	300	300
Land, easements & rights-of-way	-	28,850	28,850
Total	16,670	40,270	56,940
SUMMARY			
Construction Cost			
Irrigation outlet	60	70	130
Joint Costs	103,730	11,050	114,780
Installation services	28,750	-	28,750
Contract administration	-	1,560	1,560
Land, easements & rights-of-way	-	149,850	149,850
Total	132,540	162,530	295,070

Sutherlin Creek Watershed

Cooper Creek Reservoir

Capacity and Cost Allocation

Total Capacity	4,385 ac. ft.	100%
Flood Prevention	785 ac. ft.)	20.4%
Sediment Storage	110 ac. ft.)	
Recreation	3,290 ac. ft.	75%
Municipal & Industrial	200 ac. ft.	4.6%

	Flood Prevention $	Recreation $	M&I Water $	Total $
Specific Costs				
Municipal Outlet				
Construction	-	-	10,000	10,000
Installation Services	-	-	2,500	2,500
Fish Screens				
Construction	-	1,300	-	1,300
Installation Services	-	300	-	300
Fencing				
Construction	-	6,000	-	6,000
Installation Services	-	1,500	-	1,500
Remaining Costs				
Land, Easements & R/W*	-	35,760	240	36,000
Construction	71,190	261,730	16,050	348,970
Installation Services	17,800	65,450	4,010	87,260
Contract Administration	750	2,740	170	3,660
Total	89,740	374,780	32,970	497,490

*Allocated in accordance with SCS Memo 64

Sutherlin Creek Watershed

Cooper Creek Reservoir

Cost Sharing

	P.L. 566 Funds $	Other Funds $	Total $
Flood Prevention			
Remaining Costs			
Construction	71,190	-	71,190
Installation services	17,800	-	17,800
Contract administration	-	750	750
Total	88,990	750	89,740
Municipal & Industrial Water			
Specific Costs			
M & I Outlet			
Construction	-	10,000	10,000
Installation services	-	2,500	2,500
Land, easements & rights-of-way	-	240	240
Remaining Costs			
Construction	-	16,050	16,050
Installation services	-	4,010	4,010
Contract administration	-	170	170
Total	-	32,970	32,970
Recreation			
Specific Costs			
Fish Screens			
Construction	650	650	1,300
Installation Services	300	-	300
Fencing			
Construction	3,000	3,000	6,000
Installation services	1,500	-	1,500
Land, easements & rights-of-way	16,380	19,380	35,760
Remaining Costs			
Construction	130,865	130,865	261,730
Installation services	65,450	-	65,450
Contract administration	-	2,740	2,740
Total	218,145	156,635	374,780

Sutherlin Creek Watershed

Cooper Creek Reservoir

Cost Sharing

SUMMARY	P.L. 566 Funds $	Other Funds $	Total $
Specific Costs			
Municipal Outlet			
Construction	-	10,000	10,000
Installation services	-	2,500	2,500
Fish Screens			
Construction	650	650	1,300
Installation services	300	-	300
Fencing			
Construction	3,000	3,000	6,000
Installation services	1,500	-	1,500
Land, easements & rights-of-way	16,380	19,620	36,000
Remaining Costs			
Construction	202,055	146,915	348,970
Installation services	83,250	4,010	87,260
Contract administration	-	3,660	3,660
Total	307,135	190,355	497,490

The listing of, and cost sharing for, single purpose structural measures are shown in Table 2. These items are recreational facilities, stream channel improvement, diversion dams, grade stabilization structure, and clearing and snagging.

City of
SUTHERLIN
Douglas County, Oregon

Post Office Box 446
Phone 2856

September 10, 1963

Sutherlin Water Control District
Sutherlin, Oregon

Dear Sirs:

The common Council of the City of Sutherlin on December 17, 1962, passed a resolution to enlarge the sponsoring group planning for the Sutherlin Creek water shed, by becoming a co-sponsor.

On November 28, 1962, a letter was written to the Sutherlin Water Control District, requesting that consideration be given in the construction plans of The Cooper Creek Dam Site for storage of water for future municipal use.

Estimated storage necessary is a request for 200 Acre feet.

It is anticipated that The City will begin to draw from this source of water supply within 10 years after the completion of the Dam.

Sutherlin is fortunate to have a large area suitable for industry and the supply of water stored in the Cooper Creek Dam will aid The City to attract new industry to the community besides assuring the City of sufficient water for an anticipated growth of population.

Very truly yours,

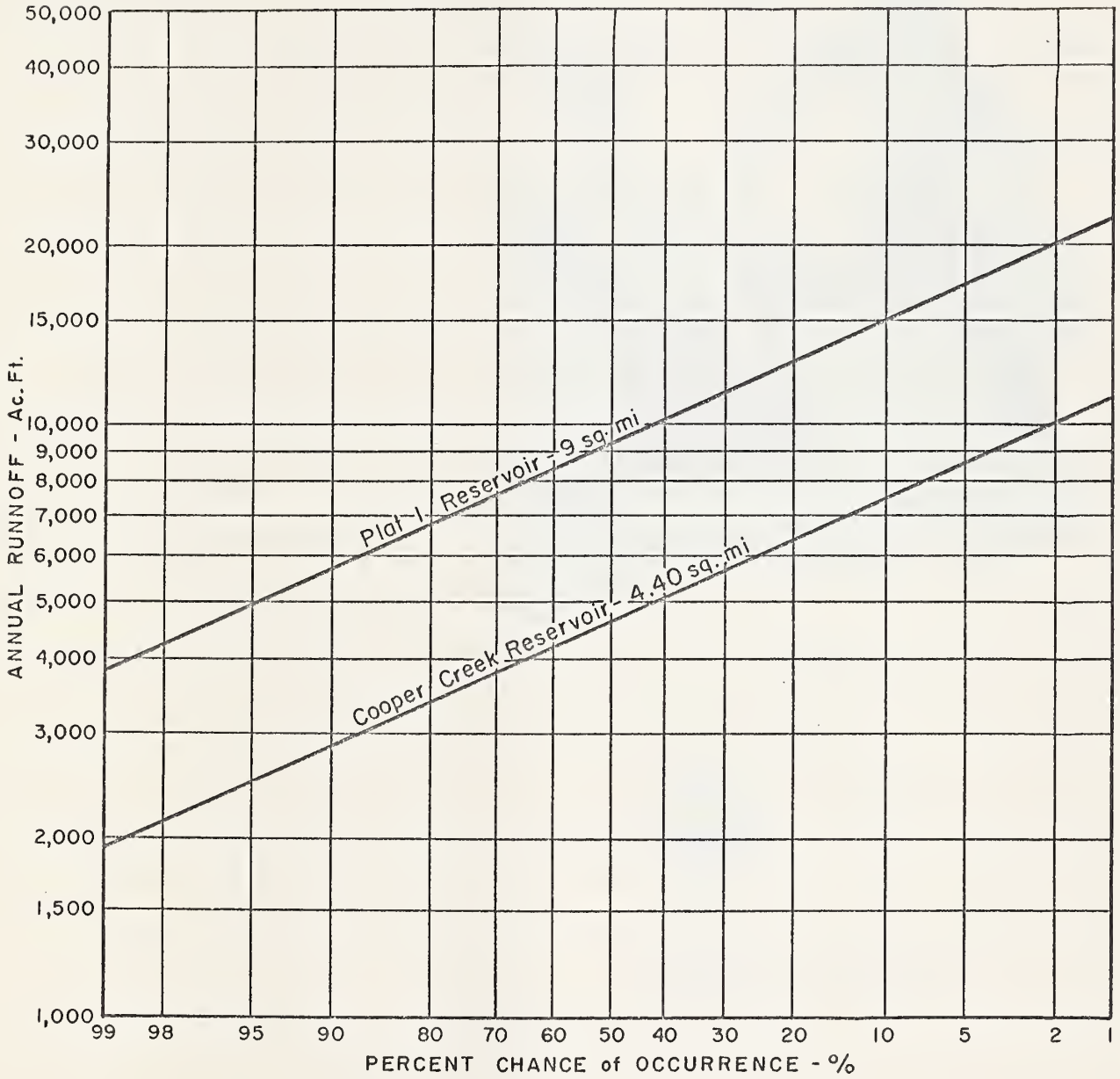
City of Sutherlin

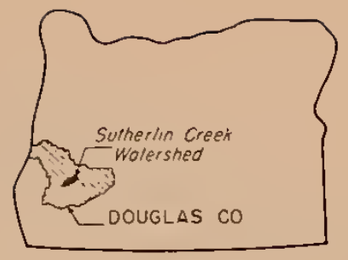
George C. Stubbert, City Manager

FIGURE 1

ANNUAL YIELD FREQUENCY CURVE

SUTHERLIN CREEK WATERSHED





LOCATION MAP

FIGURE 2

WORK PLAN

PRESENT LAND USE

SUTHERLIN CREEK WATERSHED

NORTH DOUGLAS S C D DOUGLAS COUNTY, OREGON

PRELIMINARY PLANS

U S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

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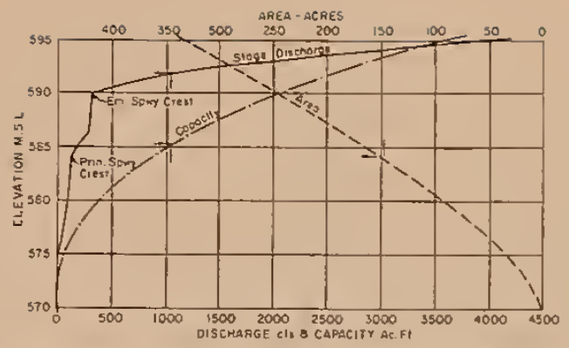
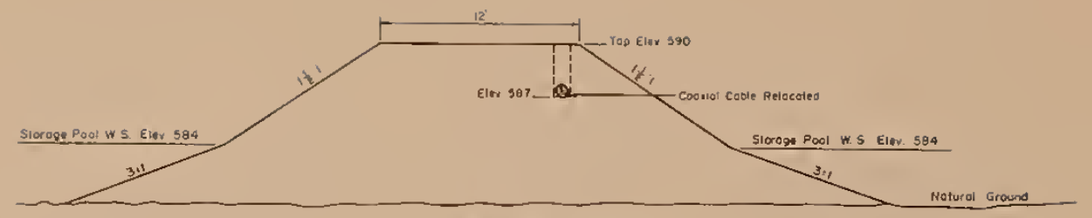


AREA–CAPACITY–DISCHARGE CURVES



TYPICAL DIKE SECTION

FIGURE 3
WORK PLAN

PLAT I RESERVOIR

SUTHERLIN CREEK WATERSHED
NORTH DOUGLAS S C D. DOUGLAS COUNTY, OREGON

PRELIMINARY PLANS

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

Prepared by D.G.B F.L.M. Date 10/63 Drwg. No 7-E-17646
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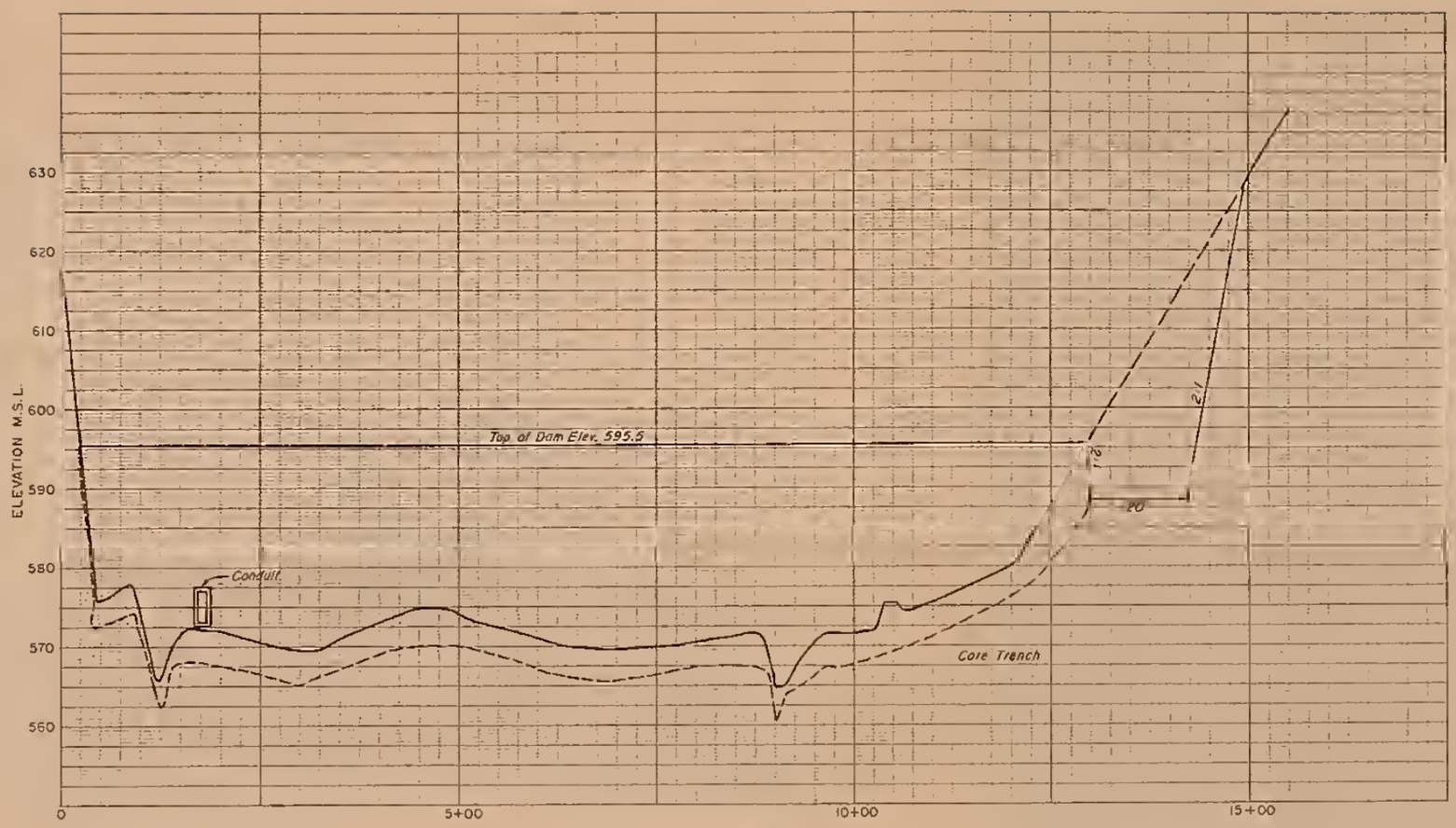
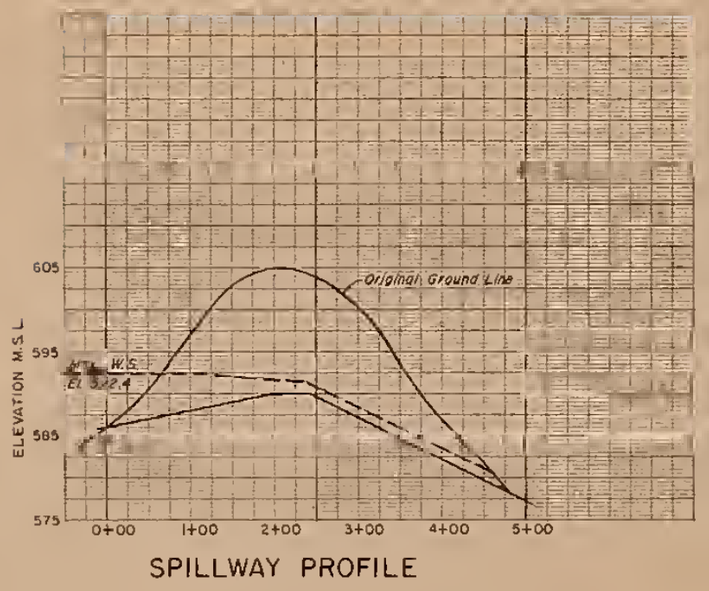
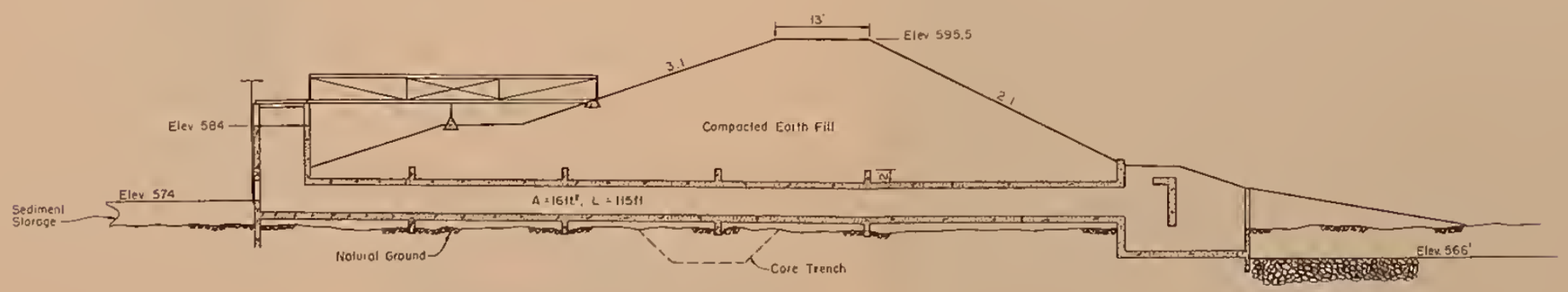


℄ PROFILE OF DAM



SPILLWAY PROFILE

	Q	dc	Vc	W.S.EL.	Sc
Emergency Spwy. Hyd.	1,350	1.6	6.5	592.4	0.0215
Freeboard Hyd.	4,600	3.5	10.3	595.5	0.0166



SECTION OF DAM ON ℄ OF OUTLET PIPE

FIGURE 4
WORK PLAN

PLAT I DAM

SUTHERLIN CREEK WATERSHED
NORTH DOUGLAS S.C.D. DOUGLAS COUNTY, OREGON

PRELIMINARY PLANS

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

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FIGURE 5

WORK PLAN

COOPER CREEK RESERVOIR & RECREATIONAL DEVELOPMENTS

SUTHERLIN CREEK WATERSHED

NORTH DOUGLAS S.C.D. DOUGLAS COUNTY, OREGON

PRELIMINARY PLANS

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

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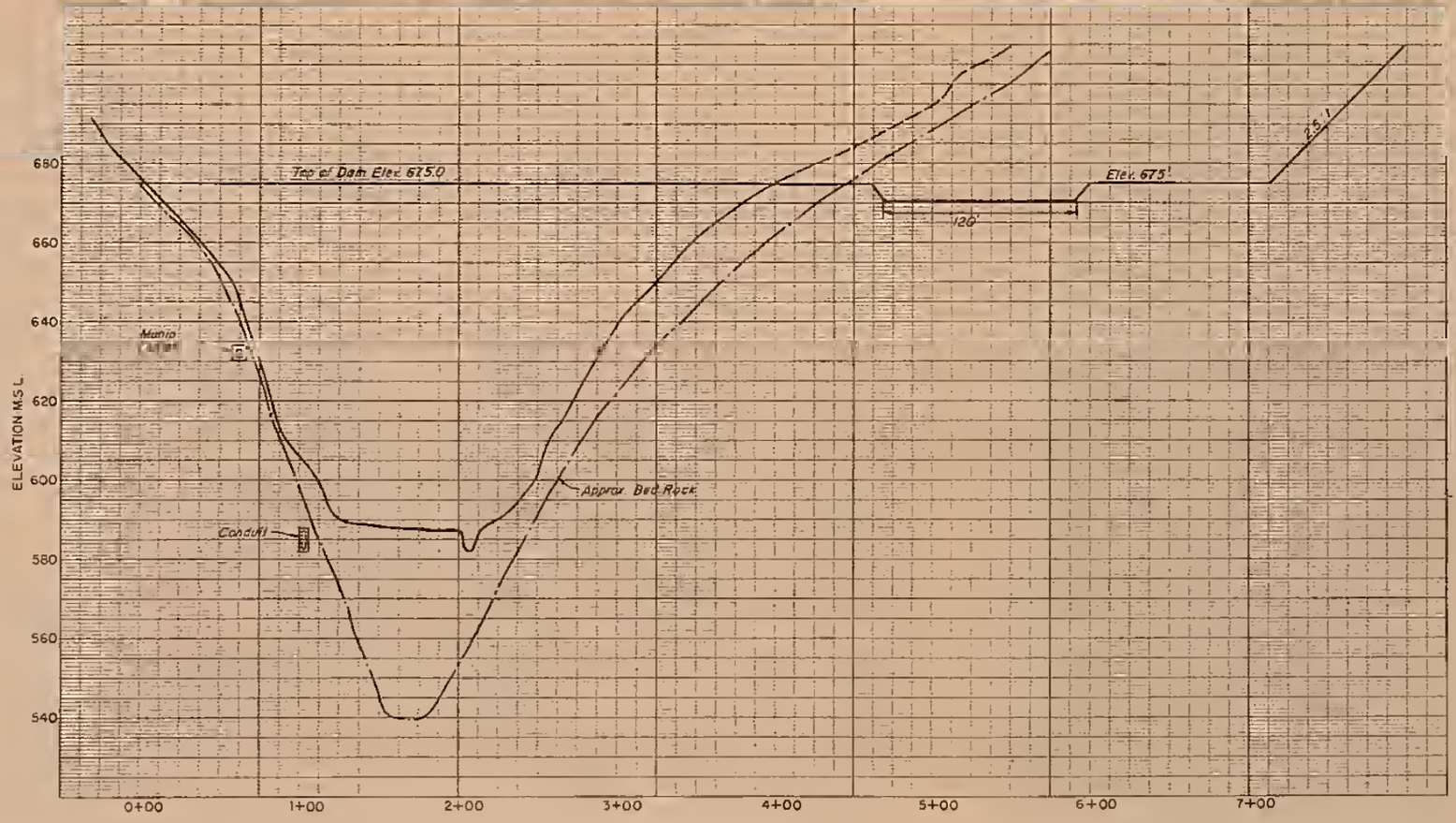
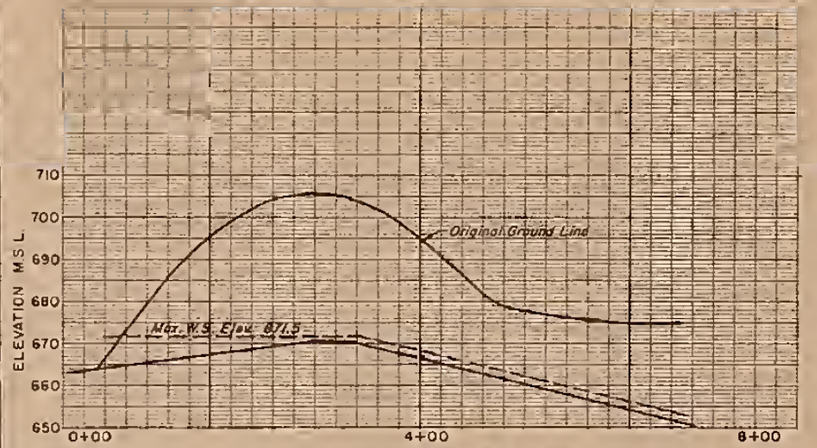
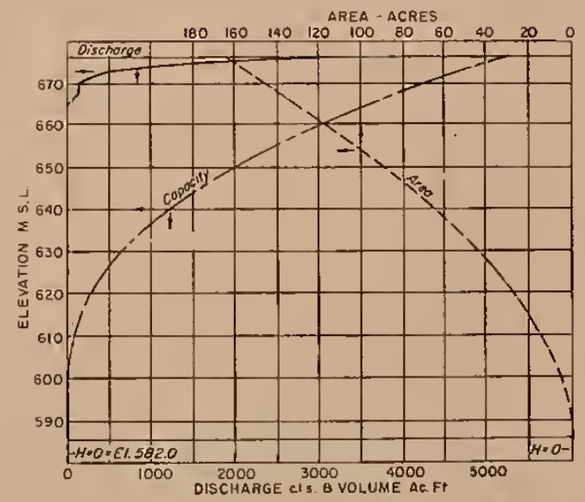


℄ PROFILE OF DAM

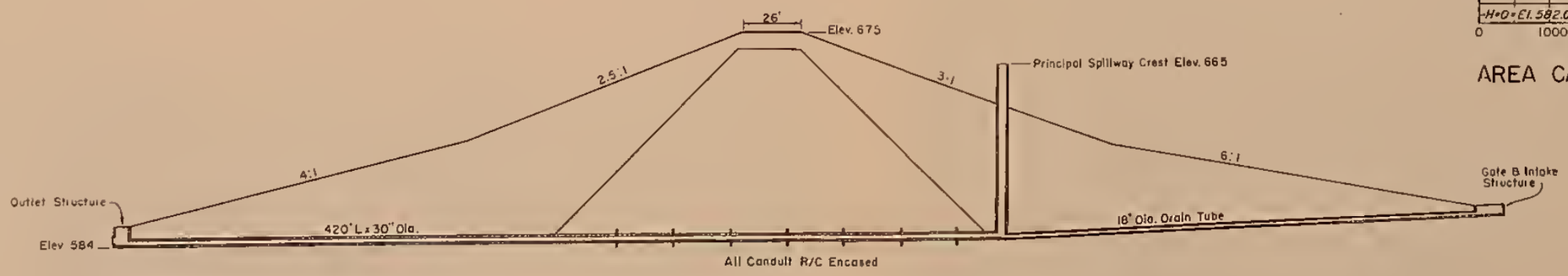


SPILLWAY PROFILE

	Q	dc	Vc	W.S.EL.	Sc
Emergency Spwy.Hyd.	450	0.8	4.6	671.5	0.026
Freeboard Hyd.	2,950	2.6	9.1	674.6	0.017



AREA CAPACITY DISCHARGE CURVES



SECTION OF DAM ON ℄ OF OUTLET PIPE

FIGURE 6
WORK PLAN

COOPER CREEK DAM

SUTHERLIN CREEK WATERSHED

NORTH DOUGLAS S.C.D. DOUGLAS COUNTY, OREGON

PRELIMINARY PLANS

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

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LEGEND

Qal — Valley alluvium - interbedded gravel, sand, silt and clay underlying valley floors.

Tuss — Umpqua Formation - interbedded siltstone, sandstone and conglomerate. Highly indurated. Sandstone and conglomerate form ridge tops.

Strike and dip of rock

Fault trace. Dashed where inferred. (U / D)

Fold axis. Dashed where inferred.

Approximate formation contact.

Sampled auger hole.

GEOLOGIC MAP

680 0 660 1320
SCALE IN FEET
CONTOUR INTERVAL = 60'

Axis - Hall Ridge — Anticline - 1.6 Miles

Sutherlin Creek

Qal, Tuss, 21, 22, 23, 26, 27

Slide Area

BORROW AREA

Cooper Creek

A — A'

800

DAM SITE CROSS SECTION

Elev. of Recreation Pool 663.5

Spillway Crest 670.5'

Interbedded siltstone and sandstone Umpqua Formation Dipping 20° to 30° to SW
Tuss

Qal

Blue Sandy Silt
Blue Clay
Blue Sandy Clay

Blue Clayey Silt

T.O. No Change

Boring No. 2

Boring No. 1

Brown Clayey Silt

Brown Sand
T.O. Boulder or Bedrock

Sandstone blocks in clayey silt matrix. No bedding observed. Probable slide area.

Springs downstream along toe of slope

Interbedded siltstone and sandstone. Dip projected from north side of ridge.
Tuss

660 640 620 600 580 560

0+00 0+50 1+00 2+00 2+50 3+00 3+50 4+00

FIGURE 7
WORK PLAN

COOPER CREEK RESERVOIR
SUTHERLIN CREEK WATERSHED
NORTH DOUGLAS S.C.D., DOUGLAS COUNTY, OREGON
PRELIMINARY PLANS
U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

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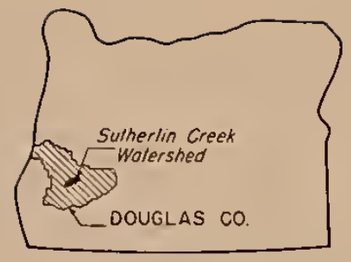

LOCATION MAP

R. 5 W.

R. 4 W.

T. 25 S.

T. 26 S.

R. 6 W.

SUTHERLIN

CENTRAL AVENUE

CAMAS SWALE CHANNEL

PLAT I RESERVOIR F I

COOPER CREEK RESERVOIR F, M, R

Richards Butte

Deady

Wilbur

Grubbe Cr.

Dimmick Cr.

Cooper Cr.

Fosset Con

Sutherlin Cr.

INTERSTATE HWY 5

S.P. & P. R.R.

NORTH UMPQUA R.

City Limits

SCALE IN MILES

NOTE : This watershed is located between latitude 43°15' and 43°30' north and longitude 123°10' and 123°25' west.

LEGEND

- Grade Stabilization Structure
- Diversion Dam
- Clearing and Snagging
- Channel Improvement For Flood Prevention
- Recreational Facilities
- Drainage Area Controlled By Structure
- Area Benefited
- Multiple Purpose Structure
  I = Irrigation R = Recreation M = Municipal
  F = Flood Prevention

WORK PLAN

PROJECT MAP

SUTHERLIN CREEK WATERSHED

NORTH DOUGLAS S.C.D. DOUGLAS COUNTY, OREGON

PRELIMINARY PLANS

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

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OREGON

1963